JULY 1990

REMEDIAL INVESTIGATION/ FEASIBILITY STUDY HEALTH AND SAFETY PLAN

LENZ OIL SERVICE, INC. LEMONT, ILLINOIS

REVISION: 1

SUBMITTED BY:

LENZ OIL SETTLING RESPONDENTS

JULY 27, 1990

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ERM PROJECT NO.: 9292

TABLE OF CONTENTS

SECTION NO.	TITLE	PAGE NO.
LIST OF TABLES		
LIST OF FIGURES		
1.0	**INTRODUCTION**	1-1
2.0	**GENERAL INFORMATION**	2-1
2.1	Project Safety Officer	2-1
2.2	Emergency Agencies	2-2
2.3	Key Project Personnel	2-3
3.0	**NATURE OF POTENTIAL HAZARDS**	3-1
3.1	Site Description	3-1
3.2	Chemical Hazards	3-2
3.3	Primary Hazards	3-3
4.0	**GENERAL WORK PROCEDURES**	4-1
4.1	Supervision and Audits of Safety Procedures	4-1
4.2	Site Control and Work Zones	4-2
4.3	General Work Rules for Field Activities	4-3
5.0	**SAFETY TRAINING AND MEDICAL SURVEILLANCE PROGRAM**	5-1
6.0	**ENVIRONMENTAL MONITORING PROGRAM**	6-1
7.0	**DECONTAMINATION PROCEDURES**	7-1
7.1	Equipment	7-1
7.2	Personnel	7-2

TABLE OF CONTENTS
(continued)

SECTION NO.	TITLE	PAGE NO.
8.0	**PERSONNEL PROTECTIVE EQUIPMENT**	8-1
8.1	Respiratory Protection	8-2
8.2	Dermal Protection/Protective Clothing	8-2
9.0	**EMERGENCY PROCEDURES**	9-1
9.1	Worker Injury	9-1
9.1.1	Decontamination	9-2
9.1.2	Transport - Hospital or Clinic	9-2
9.1.3	First Aid Procedures	9-2
9.1.4	Record Keeping	9-5
9.2	Fires	9-6
9.3	Spills	9-7
9.4	Evacuation Plan	9-8

REFERENCES

APPENDICES

A	Potential Hazards - Compounds Detected During Previous Investigations
B	HNu Meter - Maintenance and Calibration
C	Certification of Completion - Initial, Site-Specific Health and Safety Training
D	Protective Equipment/Decontamination Procedures

LIST OF FIGURES

FIGURE NO.	TITLE	FOLLOWING PAGE NO.
2-1	Evacuation Route	2-2
7-1	Decontamination Layout Level C Protection	7-2
9-1	Incident Safety Check Off List	9-5
9-2	Evacuation Rendezvous Location	9-8
9-3	Visitor and Employee Log (Daily Sign-in/Sign-out Sheet)	9-8

LIST OF TABLES

TABLE NO.	TITLE	FOLLOWING PAGE NO.
3-1	Site Contaminants Detected During Previous Investigations	3-2
3-2	Hazard Monitoring	3-2

1.0 INTRODUCTION

This Health and Safety Plan contains the requirements necessary to protect employees, on-site personnel, and the general public during the Remedial Investigation (RI) at the Lenz Oil Site located in Lemont, Illinois. Field work at the site includes: (1) collection of samples from soil gas, soil borings, surface soil, sediment, surface water and ground water; and (2) installation of monitoring wells. All of the health and safety procedures described in this Plan are specifically related to the field work being conducted and the time frame during which this work is being performed. The duration of the design studies and subsequent remedial efforts has not been defined.

Health and safety are important concerns during the field work related to the RI. The objectives of this Health and Safety Plan are: (1) to provide safety procedures to be followed during the field work, and (2) to establish emergency response procedures for extraordinary conditions that may occur during that work period. These procedures are based on an analysis of site-specific potential hazards and the appropriate protective measures to mitigate these hazards. The health and safety procedures presented in this Plan are in accordance with the appropriate requirements of the Occupational Safety and Health Administration (OSHA), as indicated in 29 CFR 1910.120, and the U.S. Environmental Protection Agency (USEPA). All operations and equipment used during the field work will comply with the OSHA regulations found in 29 CFR 1910.120 and all applicable parts of 29 CFR 1910 and 1926.

The health and safety protocols established in this Plan are based on site conditions and chemical hazards known or anticipated to be present. Specifications presented herein are subject to review and

revision based on actual conditions encountered during field activities. Prior to the commencement of field activities, all on-site personnel will have read and understood this Plan.

2.0 GENERAL INFORMATION

The names and responsibilities of designated safety personnel, emergency telephone numbers, and the address of and evacuation route to the nearest hospital are indicated in the following subsections.

2.1 Project Safety Officer

David Baron, the ERM Project Safety Office (PSO), is responsible for ensuring that all project personnel comply with the provisions of this Health and Safety Plan during the investigation activities. The PSO is responsible for ensuring that proper medical surveillance is being maintained, providing hazard communication information, training employees in safe operating procedures, and advising the Project Manager on any matters concerning the health and safety of employees or the public.

The ERM On-Site PSO, who is responsible for the development and implementation of this Plan, will verify compliance at the work site. The On-Site PSO, will supervise all daily safety, decontamination, and environmental monitoring activities associated with the field work and report to the PSO and Project Manager. Both the PSO and the On-Site PSO have the authority to stop work in the event of an emergency, equipment breakdown, unsafe procedure, or unsafe condition; to start work following any stoppage; and to approve any modifications to the Health and Safety Plan requirements that may be warranted based on field conditions. The foregoing organizational structure will be periodically reviewed and updated as necessary to reflect the current status of operations at the work site. Frequent and regular inspections of site operations will be conducted to ensure compliance with this

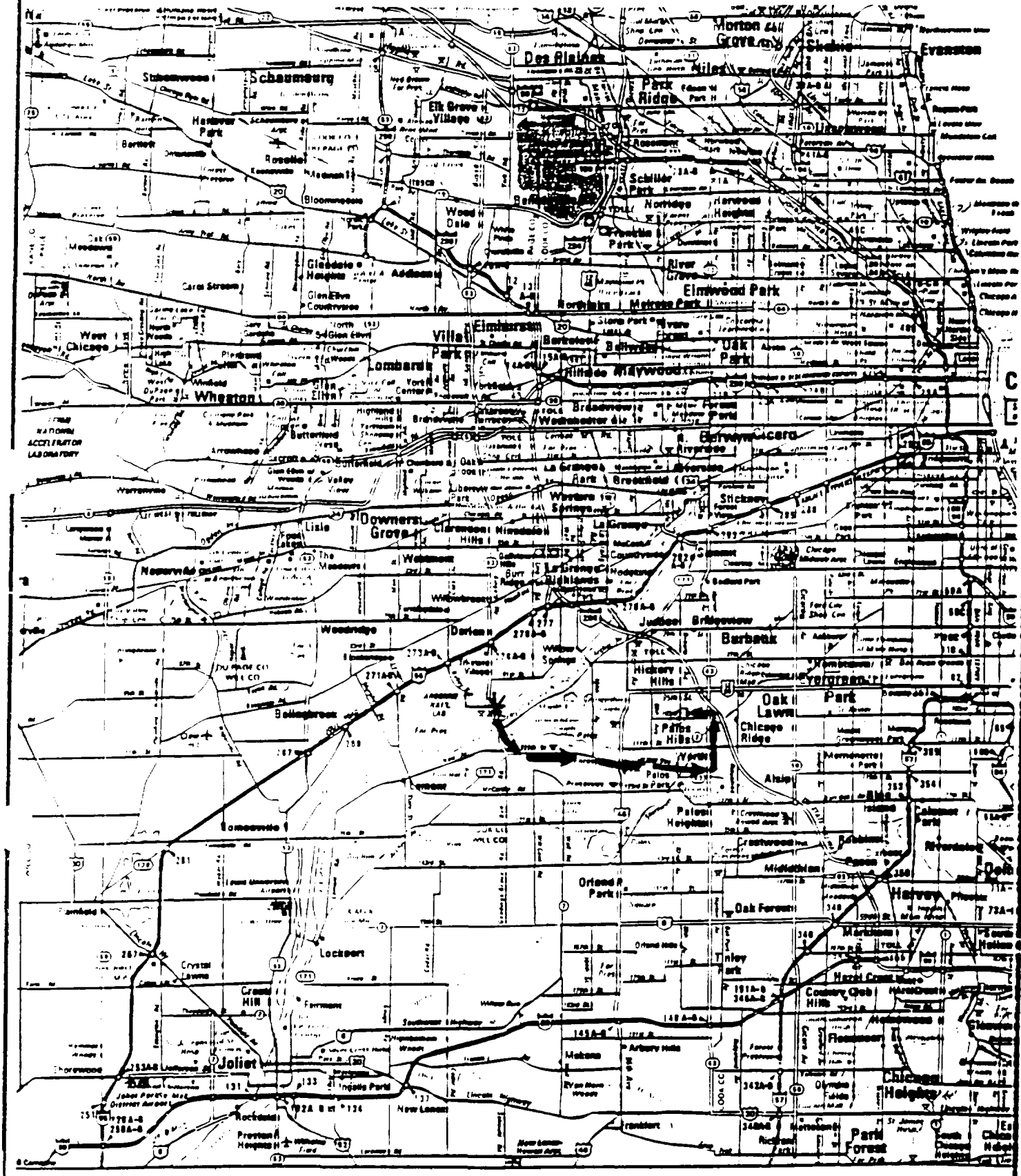
Health and Safety Plan. If any changes occur in the operations, the Plan will be modified accordingly.

2.2 Emergency Agencies

If an emergency occurs at the Lenz Oil Site that is related to the performance of the field work, appropriate emergency agencies will be contacted. The following emergency telephone numbers will be recorded in all field notebooks and posted at the decontamination facilities:

AGENCY	TELEPHONE NUMBER
National Response Center	(800) 424-8802
Illinois Emergency Services and Disaster Agency	(800) 782-7860
Ambulance Service	(708) 257-2221
Fire Department	(708) 257-2221
Police Department	(708) 257-2226
Palos Community Hospital 123rd & 80th Ave., Palos Hills	(708) 361-4500

The evacuation route to Palos Community Hospital, shown on Figure 2-1, will be in the possession of all appropriate field personnel and posted at the decontamination facilities. The hospital, police department, and fire department will be contacted prior to initiating the investigation activities and notified of the chemical compounds that may be encountered during the field work.



EVACUATION ROUTE	FIGURE 2-1
ERM ERM-North Central, Inc.	1/18/90

2.3 Key Project Personnel

The following personnel will have the primary responsibility of ensuring conformance to the Health and Safety Plan:

TITLE	NAME	AFFILIATION TELEPHONE NO.
Project Manager	J.P. Imse	ERM-North Central (708) 940-7200
Project Safety Officer	D. Baron	ERM-North Central (708) 940-7200

The Project Manager (PM) has the responsibility for the performance of the work in a safe manner. The PM will ensure that all legal and safety requirements are met. The Site Supervisor (SS) is the On-Site Project Safety Officer and overseer of operations. It is the duty of the SS to maintain site security, supervise the project employees, and ensure that all procedures (e.g., health and safety, decontamination, and protective equipment) are followed.

3.0 NATURE OF POTENTIAL HAZARDS

3.1 Site Description

The Lenz Oil site is located in the Des Plaines River floodplain at the foot of a 75-foot bluff, which defines the northern edge of the river valley. A small topographic high is situated southwest of the site, and the Des Plaines River Diversion Channel is approximately 600 feet to the southeast. The regional slope is toward the Des Plaines River (southeast), but the on-site slope is toward the northwest. A small, southwest-flowing ephemeral drainage ditch is situated along the northwest border of the site. Current site topography is a result of the placement of incinerated soil and regrading of the site by IEPA following the Expedited Remedial Activity (ERA) completed in 1988.

The approximately 4.5-acre site has undergone considerable change during the remediation activities. Prior to remediation, the following features were located on the site: a wood-frame office building, a concrete block maintenance building, a concrete block parking shed, a metal structure, a number of above-ground and below-ground tanks, several tank trucks, a former lagoon pit, and a cinder pile. A fence with two access gates along the Jeans Road enclosed the active portion of the facility. Thirteen monitoring wells were installed in the vicinity of the site, two by Lenz Oil Service, Inc. (OW-1 and OW-2), and eleven by the IEPA (G-101 to G-106).

Currently the site is devoid of all original structures, including buildings, tanks, tank trucks, piles, and most of the original fence. The ground surface has been regraded and recently planted with grass seed. A wire fence was erected at the property boundary along Jeans Road and along part of Route 83. Monitoring wells OW-1 and OW-2 have been removed and monitoring wells G-105S and G-105D

appear to have suffered damage during remediation. Although the security of the monitoring wells in clusters G-101, G-102, and G-104 has not been compromised, the wells in clusters G-105 and G-106 are currently unlocked or missing the lid on the protective covering.

3.2 Chemical Hazards

Table 3-1 summarizes the primary contaminants indicated during the previous work conducted at the site and their corresponding threshold limit values for inhalation (TLVs) and permissible exposure limits (PELs). Permissible exposure limits are legal and enforceable standards set by the Occupational Safety and Health Administration. Threshold limit values are recommendations from the American Conference of Governmental Industrial Hygienists (ACGIH), which are not legally enforceable, but are provided for reference. A summary of dermal toxicity data, obtained from USEPA's "Standard Operating Safety Guides," is also included as part of Table 3-1. The potential hazards of the compounds detected at the site are further described in Appendix A.

If air monitoring performed with an HNu or equivalent instrument indicates a sustained organic vapor concentration equal to or above 1 ppm above background in the breathing zone, Level C respiratory protection (air-purifying respirators) will be required (See Table 3-2). All preventative maintenance and calibration will be performed in accordance with the manufacturer's operation manuals. (See Appendix B.)

The dermal toxicity data show a moderate dermal toxicity for the majority of substances. Therefore, chemical-resistant gloves (such as neoprene or nitryl) will be required for any task in which dermal contact with contaminated materials is possible.

TABLE 3-1

SITE CONTAMINANTS DETECTED
DURING PREVIOUS INVESTIGATIONS

Volatile Organic Compounds	CAS Number	Sample Matrix	Threshold Limit Value (ppm)	Exposure Limits (ppm)
Vinyl Chloride	75-01-4	GW	5	1
Chloroethane	75-00-3	GW	--	5
1,1-Dichloroethane	75-34-3	LW, GW, S	--	100 (400 mg/m^3)
1,2-Dichloroethene (total)	540-59-0	GW		
1,1,1-Trichloroethane	71-55-6	LW, GW, S	350	450
1,2-Dichloroethene (cis)	156-60-5	GW	--	--
Benzene	71-43-2	LW, GW, S	1	5
Tetrachloroethene	127-18-4	LW, GW, S	50	100
Trichloroethene		LW, S		
Toluene	108-88-3	LW, GW, S	100	200
Ethyl Benzene	100-41-4	LW, GW, S	100	125
Xylenes (Total)	1330-20-7	LW, GW, S	100	100 (435 mg/m^3)
Methyl Ethyl Ketone (2-Butanone)	78-93-3	GW, S	200	--
1,2 Dichloroethane	107-06-2	GW, S	--	--
Methylene Chloride		S		
4-Methyl-2-Pentanone		S		

TABLE 3-1

SITE CONTAMINANTS DETECTED
DURING PREVIOUS INVESTIGATIONS

II Semivolatile Organic Compounds	CAS Number	Sample Matrix	Limit Value (ppm)	Limits (ppm)
Phenol	108-95-2	LW, GW	5	--
2,4-dimethylphenol		LW		
Isophorone	78-59-1	GW	5	--
Naphthalene	91-20-3	LW, GW	10	15
2-Methylnaphthalene	91-57-6	LW, GW	--	--
Dimethylnapthalene	--	LW, GW	--	--
Trimethylnapthalene	--	LW, GW	--	--
Anthracene	120-12-7	LW, GW	--	--
III PCBs and Pesticides				
Aroclor 1016		LW		
Aroclor 1242		LW		
Aroclor 1248		LW		
Aroclor 1260		LW		
Total PCBs		LW, GW		

TABLE 3-1

SITE CONTAMINANTS DETECTED
DURING PREVIOUS INVESTIGATIONS

IV Inorganic Analytes (continued)	CAS Number	Sample Matrix	Limit Value (ppm)	Limits (ppm)
Boron				
Iron	1309-37-1			10
Lead	7439-92-1	LW	0.15 mg/m^3	50 mg/m^3
Chromium	7440-47-3	LW	0.5 mg/m^3	1 mg/m^3
Antimony		LW		
Arsenic		LW		
Barium		LW		
Beryllium		LW		
Cadmium		LW		
Copper		LW		
Mercury		LW		
Nickel		LW		
Selenium		LW		
Zinc		LW		

KEY:

-- Data not Available
S - Soil
GW - Ground Water
LW - Liquid Waste from Drums, Trucks and Tank Trucks

TABLE 3-2

HAZARD MONITORING

HAZARD	MONITORING METHOD	ACTION LEVEL*	PROTECTIVE MEASURES
Oxygen Deficiency	Oxygen Monitor	>19.5%	No respiratory protection needed
		<19.5%	Ventilate Area
Organic Vapors	Photoionization Detector (PID)	Background	No respiratory protection needed
		Background to 5 ppm above background	Full face respirator with organic vapor cartridges
		5 ppm above background to 500 ppm above background	Self contained breathing apparatus
		500 ppm above background to 1,000 ppm above background	Fully encapsulated suit
Hydrogen Cyanide	HCN Meter	<10 ppm	No respiratory protection needed
		>10 ppm	EVACUATE the area

* Within the breathing zone.

Source: U.S. Environmental Protection Agency, "Standard Operating Guides," July 1988.

Numerous other exposure pathways are potential hazards to on-site personnel to a much lower degree than the inhalation and dermal contact routes. Precautions should be taken to avoid the following potential exposure pathways:

- Ingestion of contaminated ground water,
- Ingestion of contaminated surface soils, and
- Eye contact with any contaminated materials.

To mitigate these potential hazards, a thorough program of personnel decontamination and hygiene will be maintained during the field work. Also, splash protection (goggles, neoprene boots, chemical-resistant gloves, and splash shields) will be used during the sampling or handling of any contaminated liquids and during the decontamination of equipment. Details relating to personal protective equipment and procedures are provided in Section 8.0 of this Health and Safety Plan.

3.3 Primary Hazards

The primary physical hazards associated with the investigation activities are cold weather exposure and heat stress. Other potential physical hazards to on-site personnel include falling, tripping, slipping, or excessive noise.

Cold weather exposure will be an occupational stress that needs to be addressed. Several factors influence the development of a cold-weather-related injury: (1) ambient temperature, (2) wind velocity, and (3) the presence of moisture.

The following precautions will be used to avoid potential frostbite injuries or hypothermia during field work:

- Thermal socks, thermal underwear, hard hat liners, or other cold-weather gear will be provided to employees.

- Periodic breaks will be required during cold-weather field activities, with an adequate supply of potable water and warm drinks provided. Any container used to distribute water or warm drinks will be clearly marked.

- Employees will be instructed to recognize the symptoms of exposure (hypothermia) and frostbite. (The first sign of frostbite may be slightly flushed skin. The skin color then changes to white or grayish yellow and finally grayish blue. Pain is sometimes felt early on but goes away later. The frostbitten area feels cold and numb, and the employee may not be aware of the injury. The signs and symptoms of hypothermia include shivering, dizziness, numbness, confusion, weakness, impaired judgment, impaired vision, and drowsiness. As hypothermia progresses, the employee may move clumsily and have trouble holding things. In later stages, he or she may stop shivering.)

- Employees who become wet from perspiration or precipitation will be instructed to return to the plant for a change of clothes.

- Cold-weather exposure hazards will be discussed during the site-specific safety training program, covered prior to the initiation of the field activities.

Heat stress is of concern during the summer months. Impermeable protective clothing, such as chemical-resistant Tyvek coveralls, will reduce the body's ability to dissipate heat, thus, increasing the chance of heat-related problems. One or more of the following measures will be used to control heat stress:

- An adequate supply of cold potable water or a commercial electrolyte solution mix will be provided to all employees. Any container used to distribute the water or electrolyte mix will be clearly marked.

- Employees will be informed of the symptoms of heat stress and heat exhaustion. (The usual signs and symptoms of heat exhaustion are cool, pale, and moist skin; heavy sweating; dilated pupils; headache; nausea; dizziness; vomiting; and near normal body temperatures. Heat stroke is life threatening. Symptoms include hot, red skin, very small pupils; and very high body temperature - sometimes as high as 105 degrees. The skin could be wet from perspiration or dry.)

- Employees involved in work tasks requiring the use of impermeable clothing will be required to take periodic breaks.

- All breaks will be taken in a shaded rest area after any required decontamination procedures have been followed. During rest periods, employees will be required to remove impermeable protective garments.

- All employees will be informed of the importance of adequate rest, replacement of lost body fluids, and proper diet to prevent heat stress.

There is a small risk associated with injuries resulting from tripping over tools or equipment, slipping on wet or icy surfaces, or exposure to noise in excess of acceptable limits. Field personnel will be made aware that protective apparel and equipment may limit visibility, hearing, and manual dexterity. As a result, the physical hazards of certain field activities will be increased. Specific precautions to prevent injuries related to physical hazards are covered in the general work procedures presented in the following section.

4.0 GENERAL WORK PROCEDURES

This section presents an overview of the health and safety issues associated with the general field work procedures at the Lenz Oil Site.

4.1 Supervision and Audits of Safety Procedures

All field work related to the RI will be audited by the Project Safety Officer (PSO) to ensure compliance with the Health and Safety Plan. The On-Site PSO will specify the level of protective clothing for field personnel involved in the investigation activities, based on the parameters outlined in Section 8.0 of this plan. All air monitoring required to determine the level of respiratory protection needed for specific field activities will be the responsibility of the On-Site PSO.

If an accident, exposure to contamination, or other emergency occurs, the On-Site PSO will stop work and determine the appropriate response actions. Field personnel will be instructed to leave the area immediately and to remain in their protective gear. Injured personnel will be removed from the immediate hazard. Evacuation routes established by the PSO prior to initiating field work will be posted at the site. During the initial field activities, the On-Site PSO will reevaluate the evacuation routes daily and establish rendezvous points. If necessary, the evacuation route will be modified, and an updated version will be posted at the site.

4.2 Site Control and Work Zones

The On-Site PSO will have discretion over the establishment of site control and work zones. Site control and the delineation of specific work zones are necessary to reduce the possibility of exposure to site contamination. Individuals without proper personal protective gear will be restricted from these zones, and authorized personnel or equipment leaving contaminated areas of the site will be decontaminated as they pass through the contamination reduction zone to prevent the spread of contaminants. Personnel and equipment in the exclusion zone will be minimized. The possibility of exposure or translocation of site contaminants will be reduced by establishing three contiguous work zones as follows:

Zone 1: Exclusion Zone

The exclusion zone, which will encompass the work areas at the plant site, will be delineated with warning tape. All personnel entering the exclusion zone must wear the level of protection specified by the On-Site PSO. An entry and exit checkpoint will be established at the periphery of the exclusion zone, and the flow of personnel and equipment into and out of the zone will be regulated to verify that established procedures are followed.

Zone 2: Contamination Reduction Zone

A contamination reduction zone will be established adjacent to the exclusion zone checkpoint to provide a transition between contaminated and clean areas. Protective gear will be cleaned and removed in Zone 2,

before a person enters a clean area. All decontamination facilities for personnel and equipment will be located within this zone.

Zone 3: Support Zone

A support zone will be established in a noncontaminated or clean area on the site upwind of intrusive sampling areas. Support facilities (used to store equipment and samples) will be located in this zone. Because normal work clothes are appropriate within the support zone, protective gear that has not been decontaminated will not be allowed in Zone 3.

The On-Site PSO will be responsible for delineating and controlling access to work zones. Additionally, the level of protection required in the exclusion zone will also be specified by the On-Site PSO.

4.3 General Work Rules for Field Activities

The following is a list of general safety rules to be followed by all personnel involved in field activities at the Lenz Oil site:

- Contaminated protective equipment (e.g., respirators, boots, and gloves) shall not be allowed in the support zone until the equipment has been cleaned or properly packaged and labeled.

- Legible precautionary labels shall be affixed to containers holding waste, debris, or disposable protective clothing.

- No eating, drinking, smoking, chewing gum, tobacco, or any practice that increases the probability of hand-to-mouth transfer and ingestion of material will be allowed within the exclusion or contamination reduction zones.

- Transportation and disposal of contaminated residuals from site activities shall comply with all applicable local, State, and Federal regulations.

- Emergency equipment shall be placed in readily accessible locations within the support zone.

- All excavation work must comply with OSHA rules, 29 CFR 1926.

- Employees will be required to wash their hands and face upon leaving the work area.

- Whenever decontamination procedures for outer garments are in effect, the entire body will be thoroughly washed as soon as possible after the protective garment is removed.

- Excessive contact with potentially contaminated substances (e.g., avoid walking

through puddles, kneeling on the ground, and leaning against drums) shall be avoided.

- Field monitoring equipment shall not be placed on potentially contaminated surfaces.

- Employees will be trained to recognize the signs and adverse effects of exposure to hazardous substances present on site.

- Prescribed drugs should not be taken unless specifically approved by a qualified physician. Alcoholic beverage consumption will not be permitted during the work day. During nonworking hours, alcoholic beverage intake should be minimized or avoided for as long as an employee is engaged in field work.

- The Health and Safety Plan will be made available to all personnel.

- All employees must be familiar with standard operating safety procedures and any additional instructions and information contained in the Health and Safety Plan.

- All personnel must adhere to the information contained in the Health and Safety Plan.

- Contact lenses cannot be worn when respirator protection is required or when the hazard of a splash exists.

- On-site employees will use the buddy system. At a minimum, a third person, suitably equipped as a backup, is required during extremely hazardous entries.

- Visual contact will be maintained between on-site pairs and safety personnel.

- During continual operations, on-site workers act as safety backup to each other. Off-site personnel provide emergency assistance.

- Communications (using radios, hand signals, or other means) must be maintained between initial entry employees at all times. Emergency communications should be prearranged in case of radio failure, necessity for evacuation of the site, or other reasons.

- Fire prevention and protection (e.g., appropriate signs for flammable liquids, smoking areas, and combustible or flammable material storage areas) will be in accordance with 29 CFR 1926.150, Subpart F.

5.0 SAFETY TRAINING AND MEDICAL SURVEILLANCE PROGRAM

All personnel and subcontractors involved in the field activities related to the RI will be required to attend an initial, site-specific safety training program. The content of this program, which will include instructions concerning possible hazards, is outlined below:

1. Introduction to the hazardous materials/waste previously identified at the site

    a. Definition of hazardous materials/waste

    b. Classification of hazardous materials/waste

    c. Potential for ignitability, corrosivity, reactivity, and/or toxicity

2. Toxicology effects of possible contaminants

    a. Expected exposure levels

    b. Routes of probable exposure

        - o respiratory tract
        - o dermal penetration

    c. Expected toxic effects

    d. ACGIH threshold limit levels

    e. Carcinogens

3. Safety planning and principles to be used on the job site

   a. Names and responsibilities of key project safety personnel

   b. Emergency medical care and treatment

   c. General safety practices

   d. Emergency telephone numbers

   e. On-site communications

4. Respiratory protection level used on-site

   a. General principles

   b. Potential hazards

   c. Protective measures provided by air monitoring, including a discussion of the type and frequency of air monitoring at the site

   d. Response (evacuation) requirements activated by abnormally high volatile organic levels in ambient air

5. Protective clothing requirements

   a. Level of protection

   b. Articles of protective clothing

   c. Purpose of each article of protective clothing

   d. Proper use of protective clothing

6. Decontamination

   a. Concern regarding proper decontamination

   b. Extent of decontamination required

   c. Personnel decontamination under normal conditions

   d. Personnel decontamination during medical emergencies

   e. Decontamination of equipment

   f. Disposal of contaminated materials

7. Review of the site control measures and work practices that will be used during each operation

8. Emergency response plan

9. Spill containment procedures

10. Review of the Health and Safety Plan

Field personnel will be required to sign a certificate to indicate that they have successfully completed the initial, site-specific training program. Copies of these certificates are included in Appendix C. All general personnel working in the exclusion zone will be documented as having completed 40 hours of health and safety training, three days of supervised field experience, 8 hours refresher training, as well as the initial site-specific training outlined in this section. The On-Site PSO will have received an additional 8 hours of specialized training.

Personnel participating in field work at the site must be enrolled in a medical surveillance program. All training requirements and medical surveillance of on-site personnel will be in accordance with 29 CFR 1910.

Additionally, prior to the initiation of work each day, a safety review will be held to discuss any modifications to this Plan that may have been warranted, based on the activities during the previous day. The emergency response plan described in Section 9.0 shall be rehearsed regularly as part of the overall training program for site operations.

6.0 ENVIRONMENTAL MONITORING PROGRAM

Based on the results of previous work conducted at the site, the primary contaminants present at the site are volatile organic compounds. Therefore, environmental health and safety monitoring during field activities will be limited to measurements of organic vapor concentrations of the ambient air in the immediate vicinity and downwind of sampling or work areas. An HNu Model PI-101 photoionization meter will be used to conduct this ambient air monitoring. An appropriate lamp for the HNu will be selected based on a review of the ionization potentials of the compounds previously detected on site. In addition, wind indicators will be visible to all site personnel. The methods for maintaining and calibrating the HNu meter are included as Appendix B.

Ambient air monitoring will be conducted during all field activities that involve intrusive sampling (including soil borings, well installation, and ground water sampling). Prior to air monitoring an intrusive activity, background readings will be obtained from an upwind, unaffected area. During intrusive sampling, the HNu will be used to monitor the breathing zone of the workers and may be used periodically to check for organic vapors in the soil. All air monitoring results will be recorded in the On-Site PSO's field notebook and will be used to specify the level of respiratory protection required for each specific field activity.

Organic vapor readings will also be obtained at selected downwind perimeter locations to assess the effect of these activities on the surrounding area. The results of these readings will also be recorded in the On-Site PSO's field notebook.

7.0 DECONTAMINATION PROCEDURES

Decontamination of equipment and personnel will be performed to prevent worker exposure to hazardous substances, to prevent cross contamination of samples, and to extend the useful life of safety equipment. All decontamination activities will be carried out within the contamination reduction zone, and any residuals generated (such as decontamination water, disposable gloves, or disposable Tyvek suits) will be placed in secure containers (55-gallon drums) for disposal in accordance with local, State, and Federal regulations.

7.1 Equipment

All equipment involved in field sampling activities will be decontaminated prior to and upon completion of sample collection. Drilling equipment will be steam cleaned prior to each boring and before being removed from the site. Pressurized steam will be used to remove all visible excess material from augers, the back of the drilling rig, and other parts of the rig that contact augers, rods, and split spoons.

Decontamination of the sampling equipment (bailers, split spoons, etc.) will be conducted according to the following procedure:

1. Wash with alconox detergent (or equivalent) and scrub with potable water or steam clean;
2. Rinse with distilled or potable water;
3. Rinse with distilled water;
4. Air dry; and
5. Place in clean polyethylene bag, or wrap in aluminum foil with shiny-side out when not in use and during transport.

Disposable sampling equipment, such as bailer rope and sampling gloves, will be replaced between samples to avoid cross contamination.

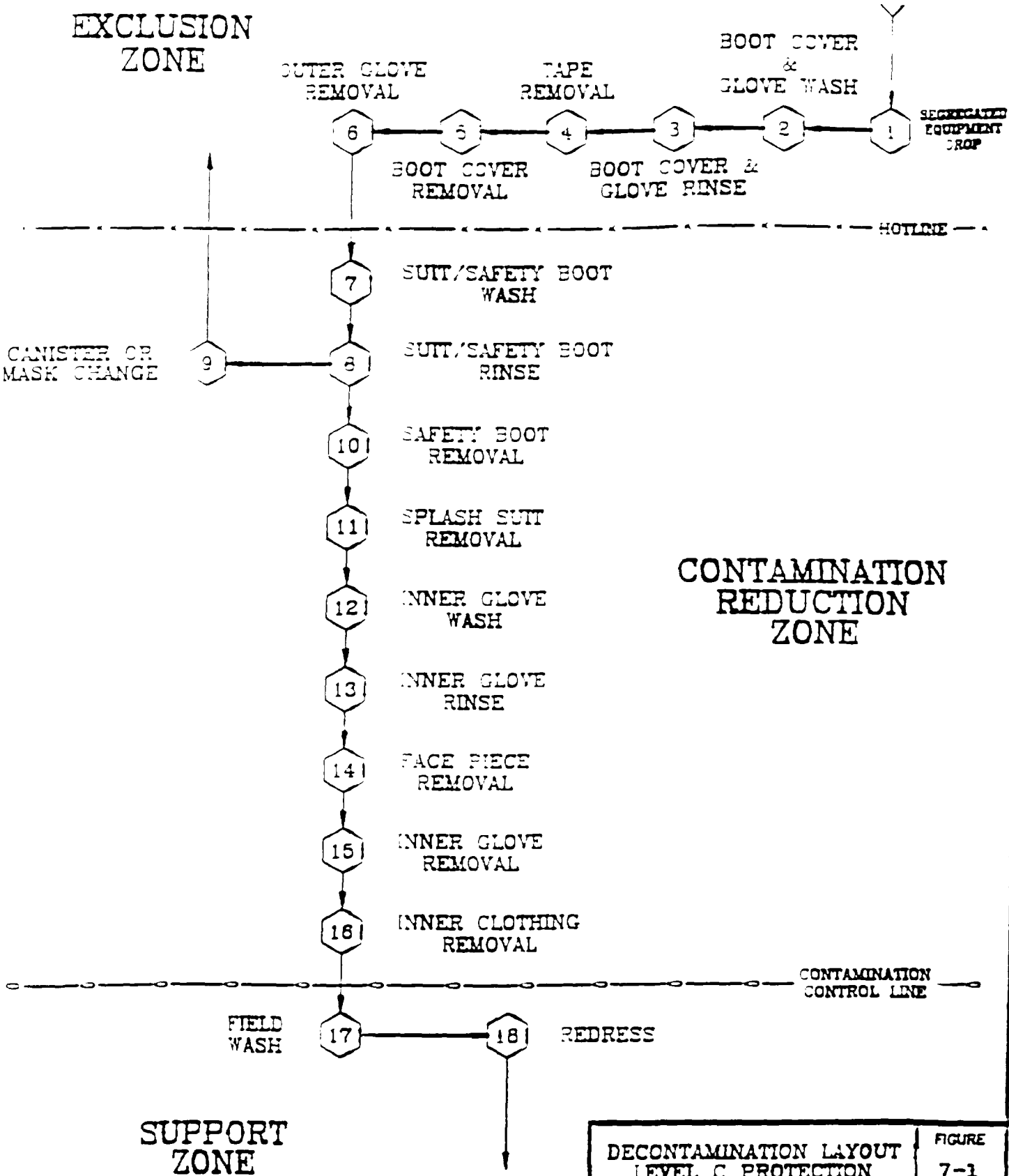
A decontamination pad will be constructed by excavating a small area and placing a thick-walled plastic liner over the entire excavation. This area will be pitched to one end to allow the drainage and accumulation of decontamination water. This water will be subsequently removed with a wet vacuum or positive displacement pump, placed in 55-gallons drums and properly disposed of in accordance with local, State, and Federal regulations. All steam cleaning, wash, and rinse procedures will be conducted within this decontamination pad.

7.2 Personnel

Personnel decontamination will consist of soap and water washing to remove contaminants from reusable protective gear (i.e., neoprene boots, chemical-resistant gloves, and full-faced respirators). Disposable protective apparel will be removed in such a manner to prevent the spread of contaminants to other clothing (i.e., remove gloves by turning them inside out).

The detailed procedure for personnel decontamination will depend on the level of respiratory protection and dermal protection required for each specific work task. The initial level of protection will be Level D (Tyvek, pullovers, and hard hat).

The general sequence of decontamination and removal of protective apparel based on Level C respiratory protection (air-purifying respirators and full-splash protection) is shown in Figure 7-1, taken from "Standard Operating Safety Guides" (USEPA, July 1988).



DECONTAMINATION LAYOUT
LEVEL C PROTECTION

FIGURE 7-1

ERM ERM-North Central Inc.

12/7/88

Various other levels of protection are indicated in Appendix D. The extent of washing required or modifications to the sequence will be specified by the On-Site PSO.

8.0 PERSONAL PROTECTIVE EQUIPMENT

All major work tasks (e.g., well installation as well as soil, soil gas, sediment, surface water, and ground water sampling) will be conducted under Level D protection unless on-site monitoring or new contaminant data indicate that upgrading to a higher level of protection is necessary. Appendix D contains a list of personal protection equipment for Levels A through D and required decontamination procedures.

8.1 Respiratory Protection

If a reading of 1 ppm above background in the breathing zone is indicated on the HNu during the field investigation, Level C respiratory protection will be required. Level C protection includes full-faced, air-purifying respirators equipped with combination cartridges for removing organic vapors, dusts, mists, and fumes. The following guidelines will be followed when using Level C respiratory protection:

- Air-purifying cartridges will be replaced at the end of each shift or when breakthrough occurs.

- Only employees who have had a pre-issue qualitative fit test will be allowed to work under Level C respiratory protection.

- Only employees who have passed a medical examination, including a pulmonary function test, will be allowed to use Level C respiratory protection.

- Excessive facial hair (e.g., beards) that prohibits a proper seal between the respirator and face will not be allowed.

8.2 Dermal Protection/Protective Clothing

In addition to normal work clothes, the following protective clothing and equipment shall be worn by any personnel entering the exclusion zone or contamination reduction zone:

- Disposable Tyvek coveralls,
- Disposable overboots,
- Disposable PVC gloves, and
- Neoprene boots with steel toe and shank.

Any work involving an intrusive sampling activity or the handling of potentially contaminated liquids or soils (e.g., soil gas, soil, sediment, or surface or ground water water sampling; soil boring drilling; well installation; or well development) will require the following additional protective clothing:

- Safety goggles or splash shields (unless full-faced respirators are required or potentially contaminated liquids are not involved);
- Chemical-resistant neoprene outer gloves; and
- Sleeves taped to gloves and cuffs taped to boots.

During work activities that present a potential overhead hazard (e.g., drilling and monitoring well installation), all personnel in the vicinity of the activity will be required to wear a hard hat. Upgrading or downgrading protective equipment will be the decision of the On-Site PSO and will be based on an assessment of the exposure potential determined from sampling and screening results.

9.0 EMERGENCY PROCEDURES

This Health and Safety Plan has been established to allow field work related to the RI to be conducted without adverse effects on work or health and safety. In addition, emergency response procedures have been developed to cover extraordinary conditions that may occur at the site.

If an emergency occurs, the On-Site PSO will notify the appropriate emergency agency and take charge of the situation until the local fire department or other emergency agency responds. At that point, the On-Site PSO will offer technical assistance to the extent possible by identifying the hazardous substances or conditions present, and addressing, as appropriate, site analysis, use of emergency controls, maximum exposure limits, hazardous substance handling, and the use of new technologies for mitigating the hazard or hazards present. Once the hazard has been mitigated, response activities will be critiqued, and, if necessary, the Health and Safety Plan will be modified.

9.1 Worker Injury

ERM professional personnel working at the site have received first aid and CPR training. If an individual becomes ill or is physically injured during the performance of field work, first aid will be administered and, if necessary, assistance will be sought. The following subsections outline the procedure to be followed in the event of a medical problem or emergency.

9.1.1 Decontamination

Any person who becomes ill or injured in the exclusion zone must be decontaminated, to the degree practical, giving due consideration to which risk will be greater: the spread of contamination or the health of the individual. If the injury or illness is minor, full decontamination should be completed prior to transport.

9.1.2 Transport - Hospital or Clinic

Employees being transported to a clinic or hospital for treatment should take with them information concerning the chemical(s) to which they have been exposed and their own medical history. This information will be kept on site at the decontamination facility.

9.1.3 First Aid Procedures

If an employee working in a contaminated area becomes ill or is physically injured, general first-aid procedures will be administered. Depending on the severity of the injury, emergency medical attention may be sought. If the employee can be moved, he or she will be taken to the support zone. Decontamination procedures, additional first aid, or preparation for transportation will be performed in the support zone.

If the injury to the worker is chemical in nature or related to the physical hazards previously identified, appropriate first-aid procedures will be instituted as follows:

- Eye Exposure - If contaminated materials enter a worker's eyes, they will be washed out, using a 15-minute eye wash kit that will be kept at the site. Medical attention will be sought immediately.

- Skin Exposure - If skin irritation results from dermal contact with contaminated materials, the affected area will be washed with a mild soap or detergent and rinsed with water for at least five minutes. Medical attention will be sought if irritation in the affected area persists.

- Ingestion - If contaminated materials are ingested, vomiting should be induced. Medical attention will be sought immediately.

- Inhalation - If an employee is overcome by fumes from chemical hazards, he or she will be moved to an area of fresh air. If necessary, medical attention will be sought.

- Hypothermia - If an employee suffers from hypothermia, medical attention should be sought immediately. The employee should be moved out of the cold and into warm clothing.

Warming should take place slowly; no food or beverage should be administered.

- Frostbite - An employee suffering from frostbite should be moved to a warm area. Frostbitten areas of the body should be placed in warm (100 to 105 degrees F) water, NOT hot water. Areas of concern should be handled gently and should not be rubbed or massaged. If toes or fingers are affected, gauze should be placed between them after warming them. The injured parts should be loosely bandaged. If the part has been thawed and refrozen, it should be rewarmed at room temperature. If necessary, medical assistance should be sought.

- Heat Stroke - If an employee suffers a heat stroke, medical attention should be sought immediately. The employee should be moved out of the heat and into a cooler area. The employee should be cooled as quickly as possibly by immersing him or her in a cool bath, or wrapping wet sheets around the body. While waiting for an ambulance to arrive, the employee should be watched for symptoms of shock. Symptoms of shock include: confused behavior,; very fast or very slow pulse rate; very fast or very slow breathing; trembling and weakness in arms and legs; cool and moist skin; pale or bluish skin, lips, and

fingernails; and enlarged pupils. Nothing should be given by mouth.

- Heat Exhaustion - If an employee suffers from heat exhaustion, he or she should be moved out of the heat and into a cooler place. The employee should lie down with his or her feet up. Clothing should be removed or loosened, and cold packs, wet towels, or sheets should be used to cool the skin. One-half glass of water should be administered every 15 minutes if the employee is fully conscious and can tolerate it. During all of these procedures, the employee should be observed for symptoms of shock. If the employee has not recovered within a half hour, or if the employee's condition worsens, medical attention should be sought.

9.1.4 Record Keeping

Exposure or the potential exposure of on-site workers during an emergency or during routing operations will be recorded on the Incident Safety Check Off List (see Figure 9-1) and in the On-Site PSO field notebook.

FIGURE 9-1

INCIDENT SAFETY CHECKOFF LIST

BEFORE FIELD ACTIVITY

Employee: _____

1. Incident: Site _____ City _____ State ____
   Response Dates _____ _____

2. Activity Description: Site Evaluation _____ Containment ____ Well Drilling ____ Facility Inspection ____
   Sampling-Air _____ Water ____ Drum _____ Soil _____ Residential ____ Other _____

3. Type of Response: Spill ____ Fire ____ Site _____ Train ____ Other ____

4. Site Topography: Mountains ___ Rivers ___ Valley _____ Rural _____
   Suburban ___ Level ___ Slopes _____ Unknown _____

5. Incident Safety Plan: Region _____ Reviewed _____
   ERT _____ Briefed _____
   Facility _____ Not Developed _____

6. Site Accessibility: Road: Good _____ Air: Good _____
   Fair _____ Fair _____
   Poor _____ Poor _____

7. Suspected Chemical(s) and Pathway with Source(s) Involved: (A) _____
   (B) _____ (C) _____ (D) _____

8. Emergency Response Teams Present for First Aid, etc. Yes _____ No _____

9. Protective Level(s) Selected: (A) _____ (B) _____ (C) _____ (D) _____
   (a) If Level "C" - Identity Canister _____
   (b) If Level "D" - JUSTIFY:

10. SCBA Incentity Buddy System: Office/Name _____

11. Last Response: (a) Level Used: (A) _____ (B) _____ (C) _____ (D) _____
    (b) Medical Attention/Exam Performed: Yes _____ No _____

I. AFTER RESPONSE

1. Protective Level Used: (A) _____ (B) _____ (C) _____ (D) _____
   (a) If Level "C" - Identity Canister _____
   (b) If Level "D" - JUSTIFY:
   (c) Level B or C Skin Protection: Tyvek ____ Tyvek/Saran ____ Acid/Rain ____ Other _____

2. List Possible Chemical Exposure: Same as above: _____ (A) _____
   (B) _____ (C) _____ (D) _____

3. Equipment Decontamination:

	(a) clothing	(b) respirator	(c) monitoring
Disposed:			
Cleaned:			
No Action:			

4. Approximate time in exclusion area _____ hours per day for _____ days

5. Was medical attention/exam required for this response: Yes _____ No _____

Part I: DATE PREPARED: _____ Reviewed by _____ Date _____
Part II: DATE PREPARED: _____ Reviewed by _____ Date _____

9.2 Fires

The local fire fighting and police authorities will be notified of the work to be conducted at the site prior to initiating field activities.

If a localized fire breaks out, dry chemical fire extinguishers will be used to bring the fire under control. Fire extinguishers will be located in the decontamination area and at each work area. If it is safe and feasible to do so, employees may:

- Use fire extinguishers to control or extinguish the fire.
- Remove or isolate flammable or other hazardous materials, which may contribute to the fire.
- Extinguish other ignitable sources.
- Place soil or other inert material on the burning area to extinguish the fire.

If appropriate, local fire fighting authorities will be contacted for notification and/or assistance. The On-Site PSO will immediately evacuate the area and take charge of the situation until the fire department responds. At that time, the On-Site PSO will advise the fire department of the location of the fire and the type of hazardous materials present. The On-Site PSO will offer additional technical assistance, as appropriate. If an uncontrolled fire develops that may release potentially toxic gases, all persons in the immediate vicinity will be evacuated. Evacuation of local residents, if required, will be the

responsibility of the local police, who will be notified of the emergency and the potential effect on the local community.

9.3 Spills

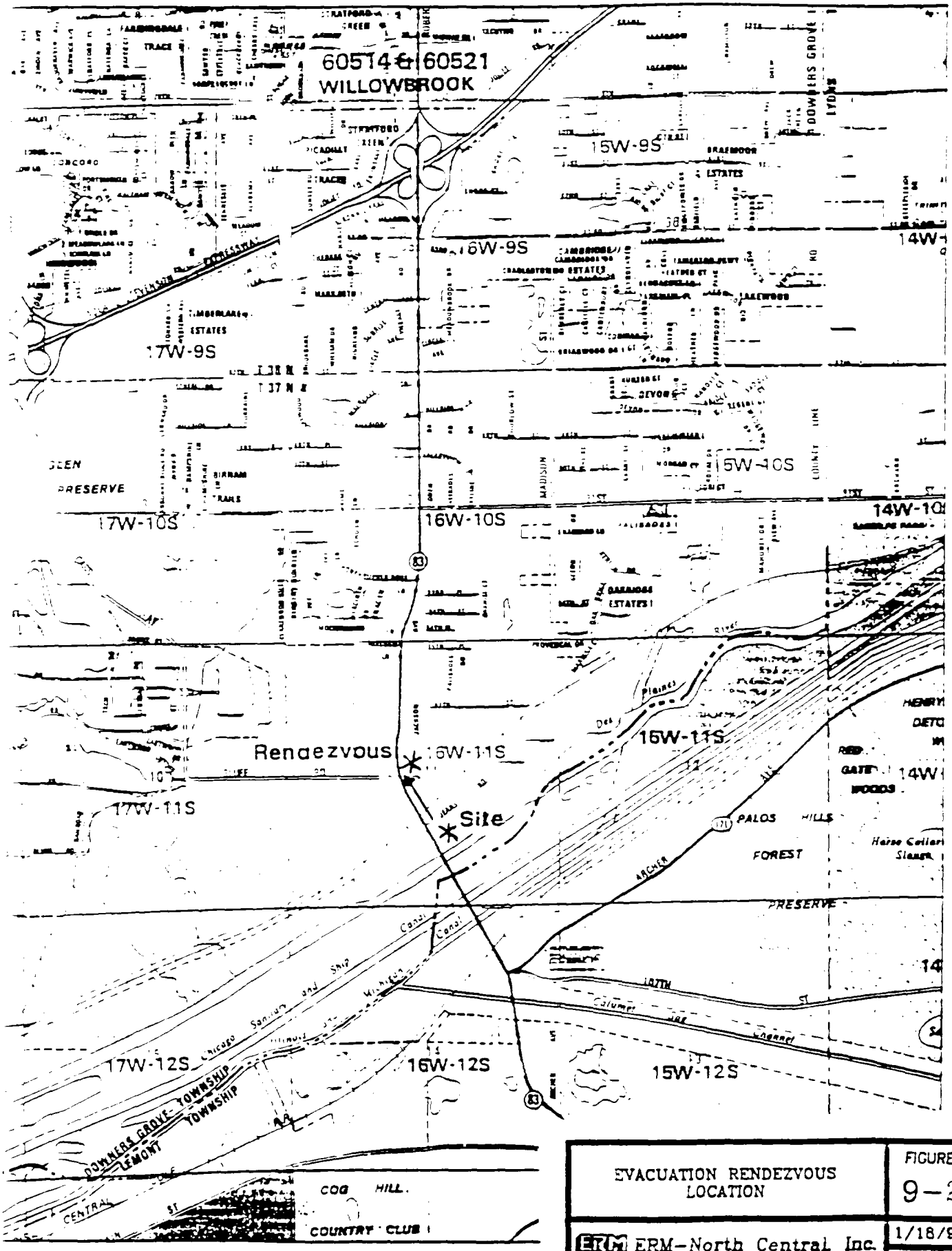
The On-Site PSO will be responsible for supervising the cleanup of minor spills. Spilled solids will be cleaned up and loaded in 55-gallon drums for subsequent disposal. Liquid spills will be solidified with absorbent material, which will be stored in the decontamination area, and loaded in 55-gallon drums for subsequent disposal. Transportation and disposal of any spill cleanup residual will be in accordance with all local, State, and Federal requirements.

In the event of a significant spill of hazardous waste or materials, the On-Site PSO will immediately evacuate the area and notify the local fire department. The On-Site PSO will take charge of the situation until the fire department responds. At that time, the On-Site PSO will advise the fire department of the location of the spill, the type of hazardous materials present, and additional technical data, as appropriate. The National Response Center will be notified at (800) 424-8802 if a reportable spill occurs.

9.4 Evacuation Plan

If an emergency necessitates evacuating field personnel, the On-Site PSO will notify the field team leader, and the appropriate signal for site evacuation (three short blasts on an air horn) will be given. All available vehicles located outside the exclusion zone will be used in the evacuation. Whenever possible, vehicles shall be parked in a manner that would effect speedy evacuation (backed in). All personnel will exit the site and meet at a nearby rendezvous point, established during the initial field work. The designated rendezvous points, which will be based on the downwind toxic corridor, will be posted at the decontamination facilities. (See Figure 9-2). The evacuation route within the site will depend on which direction affords the most direct route away from the hazard necessitating the evacuation.

The visitor and employee logs will be used to ensure that all individuals are accounted for during an emergency situation. The On-Site PSO will be responsible for maintaining these daily sign-in/sign-out sheets. (See Figure 9-3). If possible, personnel should exit the site through the contamination reduction zone and doff personal protective equipment in the required manner. Otherwise, decontamination procedures will be performed as required and as feasible after all personnel have exited the site. Evacuation of the local community, if necessary, will be the responsibility of the local police or fire departments.



EVACUATION RENDEZVOUS LOCATION	FIGURE 9-2
ERM ERM-North Central Inc.	1/18/90

FIGURE 9-3

Visitor and Employee Log
Daily Sign-In/Sign-Out Sheets

DATE	IN AT (HRS)	OUT AT (HRS)	NAME	COMPANY

REFERENCES

1. United States Environmental Protection Agency (USEPA), 1988, "Standard Operating Safety Guides."

2. OSHA - Hazardous Waste Operations and Emergency Response, Final Rule, 29 CFR Part 1910, March 6, 1989.

3. United States Environmental Protection Agency (USEPA), 1985, "Guidance on Remedial Investigation Under CERCLA."

4. United States Environmental Protection Agency (USEPA), 1986, "Superfund Public Health Evaluation Manual."

5. United States Environmental Protection Agency (USEPA), 1986, Toxicology Handbook: "Principles Related to Hazardous Waste Site Investigations."

6. American Conference of Government Industrial Hygienists (ACGIH), 1988, "Threshold Limit Values and Biological Exposure Indices for 1988-1989."

APPENDIX A

POTENTIAL HAZARDS - COMPOUNDS DETECTED DURING PREVIOUS INVESTIGATIONS

APPENDIX A
(Page 1 of 5)

LENZ OIL SITE

SYMPTOMS OF OVEREXPOSURE, POTENTIAL CHRONIC EFFECTS,
AND FIRST-AID TREATMENT

	Symptoms of Overexposure				
Compound	Eye	Skin	Inhalation/Ingestion	Target Organs for Potential Chronic Effects	First Aid Treatment
1,1-Dichloroethane	Irritation	Dermatitis	Central nervous system depressant, drowsiness, unconsciousness, liver, kidney damage	Skin, liver, kidneys	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately
1,2-Dichloroethene (trans)	Irritation	None	Irritation of eyes and respiratory system, central nervous system depression	Respiratory system, eyes, central nervous system	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately
1,2 Dichloroethene (cis)	----	----	----	----	
1,1,1-Trichloroethane	----	----	----	----	----
Tetrachloroethene	Irritation	None	Irritation of eyes, nose and throat; nausea; flush face and neck; vertigo, dizziness and incoordination; headache; somnolence; erythema	Liver, kidneys, eyes, upper respiratory system, central nervous system	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately
Benzene	Irritation	Dermatitis	Irritates eyes, nose, respiratory system, giddy, headache, nausea, staggered gait, fatigue, anorexia, lassitude, bone marrow depression, abdominal pain	Central nervous system, blood, skin, bone marrow, eyes, respiratory system	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately

LENZ OIL SITE

SYMPTOMS OF OVEREXPOSURE, POTENTIAL CHRONIC EFFECTS,
AND FIRST-AID TREATMENT

	Symptoms of Overexposure				
Compound	Eye	Skin	Inhalation/Ingestion	Target Organs for Potential Chronic Effects	First Aid Treatment
Toluene	Irritation	Dermatitis	Fatigue, weakness, confusion, euphoria, dizziness, headache, dilated pupils, lacrimation, nervousness, muscle fatigue, insomnia, paresthesia, photophobia	Central nervous system, liver, kidneys, skin	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately
Vinyl Chloride	----	----	Weakness, abdominal pain, gastrointestinal bleeding, hematomegaly, pallor or cyanosis of extremities	liver, central nervous system, blood, respiratory system, lymphatic system	Eye: --- Skin: --- Breath: Artificial respiration Swallow: ---
Chloroethane	----	----	-	- - -	----
Phenol	Irritation	Dermatitis	Respiratory irritation, anorexia, weakness, muscle ache, cyanosis, ochronosis, tremor, convulsions, twitching	liver, kidneys, skin	Eye: Irrigate immediately Skin: Soapwash immediately Breath: Artificial respiration Swallow: Medical attention immediately
Anthracene	----	----	----	----	----
Methyl Naphthalene	----	----	----	----	---
Dimethyl Naphthalene	----	----	----	----	----

LENZ OIL SITE

SYMPTOMS OF OVEREXPOSURE, POTENTIAL CHRONIC EFFECTS,
AND FIRST-AID TREATMENT

	Symptoms of Overexposure				
Compound	Eye	Skin	Inhalation/Ingestion	Target Organs for Potential Chronic Effects	First Aid Treatment
Trimethyl Naphthalene	----	----			
1,2 Dichloroethane	----	----	----		----
Methyl ethyl ketone	Irritation	Irritation	Dizziness, vomiting, headache, nose irritation	Central nervous system, lungs	Eye: Irrigate immediately Skin: Water wash immediately Breath: Fresh air Swallow: Medical attention immediately
Ethyl benzene	Irritation	Dermatitis	Mucous membranes, headache, necrosis, coma	Eyes, upper respiratory system, skin, central nervous system	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately
Xylenes, total	Irritation	Dermatitis	Excitement, drowsiness, incoordination, staggering gait; irritation to eyes, nose, throat; corneal vacuolization, anorexia, vomiting, abdominal pain	Central nervous system gastrointestinal (GI) tract, blood, liver, kidneys, skin	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately
Isophorone	Irritation	Dermatitis	Dizziness, headache, nose and throat irritation, narcosis	Respiratory system, skin	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately

APPENDIX A
(Page 4 of 5)

LENZ OIL SITE

SYMPTOMS OF OVEREXPOSURE, POTENTIAL CHRONIC EFFECTS,
AND FIRST AID TREATMENT

	Symptoms of Overexposure				
Compound	Eye	Skin	Inhalation/Ingestion	Target Organs for Potential Chronic Effects	First Aid Treatment
Naphthalene	Irritation	Dermatitis	Headaches, confusion, excitement, malaise, nausea, vomiting, abdominal pain, irritation of bladder, profuse sweating, jaundice, hematuria, hemoglobinuria, renal shut-down	Eyes, blood, liver, kidneys, skin, red blood cells, central nervous system	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately
PCB	----	----	---	-	- - -
Lead (inorganic fumes and dusts)	Irritation	Dermatitis	Lassitude, insomnia palor, anorexia, low weight, malnutrition, constipation, abdominal pain, colic, hypotension, anemia, gingival lead line, tremors, paralysis of the wrist	Gastrointestinal tract, central nervous system, kidneys, blood, gingival tissue	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately
Chromium metals and insoluble salts	Irritation	Dermatitis	Histologic fibrosis of lung, cancer	Respiratory system	Eye: Irrigate immediately Skin: Soap wash promptly Breath: Artificial respiration Swallow: Medical attention immediately

LENZ OIL SITE

SYMPTOMS OF OVEREXPOSURE, POTENTIAL CHRONIC EFFECTS, AND FIRST-AID TREATMENT

	Symptoms of Overexposure				
Compound	Eye	Skin	Inhalation/Ingestion	Target Organs for Potential Chronic Effects	First Aid Treatment
Boron	----				
Iron	----	----	----		----

Key:

---- Denotes that no information was provided in the NIOSH "Pocket Guide to Chemical Hazards," 1985.

APPENDIX B

HNu METER - MAINTENANCE AND CALIBRATION

OPERATIONAL PROCEDURE FOR

HNu MODEL PI 101

PHOTOIONIZATION ANALYZER

PREPARED BY

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TABLE OF CONTENT

I. INSTRUCTION

1.0 OPERATION PRINCIPLE

2.0 INSTRUMENT SENSITIVITY AND CALIBRATION

3.0 INSTRUMENT SPECIFICATIONS

II. OPERATIONAL PROCEDURE

1.0 INSTRUMENT CHECKOUT

2.0 FIELD OPERATION

2.1 CALIBRATION

2.1.1 EQUIPMENT AND MATERIALS

2.1.2 CALIBRATION FREQUENCY

2.1.3 CALIBRATION PROCEDURE

2.2 SAMPLE MEASUREMENTS

III. MAINTENANCE AND TROUBLE SHOOTING

1.0 BATTERY RECHARGING

2.0 GENERAL FAULTS DETERMINATION AND CORRECTION

3.0 SPECIFIC FAULTS

OPERATION PROCEDURE FOR
HNu MODEL PI 101
PHOTOIONIZATION ANALYZER

I. INTRODUCTION

1.0 Operation Principle

The HNu Model 101 photoionization detector has been designed to measure the concentration of trace gases in many industrial or plant atmospheres. The instrument has similar capabilities outdoors. The analyzer employs the principle of photoionization for detection. This process is termed photoionization because the absorption of ultraviolet light (a photon) by a molecule leads to ionization via:

$$RH + h\nu \longrightarrow RH^{+} + e^{-}$$

where RH = trace gas
$h\nu$ = a photon with an energy greater than or equal to an ionization potential of RH.

The sensor consists of a sealed ultraviolet light source that emits photons which are energetic enough to ionize many trace species (particularly organics), but do not ionize the major components of air such as O_2, N_2, CO, CO_2 or H_2O. A chamber adjacent to the ultraviolet light source contains a pair of electrodes. When a positive potential is applied to one electrode, the field created drives any ions, formed by absorption of UV light, to the collector electrode where the current (proportional to concentration) is measured. The useful range of the instrument is from a fraction of a ppm to about 2,000 ppm.

2.0 Instrument Sensitivity and Calibration

The instrument responds to atmospheric compounds with ionization potentials equal to or less than the ionization energy of the UV light source. If a compound in air has an ionization potential greater than the energy source of the lamp, it will not be detected. Table 1 presents organic and inorganic compounds and the light sources that should be used to detect each compound. The instrument is capable of using 1 of the 3 light sources - 9.5, 10.2, and 11.7 ev lamps. In addition, not all compounds respond equally to each light sources and thus they vary in their sensitivity to ionization. As a result of varying sensitivities to photoionization, the response given by the instrument may or may not reflect the actual atmospheric concentration of the compound being detected. Table 2 represents the relative sensitivities for various gases relative to a 10.2 ev light source. Use this table to determine the approximate response of the instrument to a compound of interest, and to select the appropriate light (lamp) source.

There are two types of operations that are used for calibration. For Type 1 Operation, a non-regulatory (or non-target) compound such as isobutylene is used for calibration. In this case, the instrument reading is reported in terms relative to the calibration compound used for calibration. For the type 2 operation, the target compound or compounds are used for calibration. As a result, the instrument is calibrated to respond directly in ppm by volume of the target compound(s).

3.0 Instrument Specifications

3.1 Performance

- Range : 0.1 to 2000 ppm
- Detection Limit : 0.1 ppm
- Sensitivity (max.) : 0 to 2 ppm FSD over 100 division meter scale
- Repeatability : ± 1% of FSD
- Linear Range : 0.1 to 600 ppm
- Useful Range : 0.1 to 2000 ppm
- Response Time : less than 3 seconds to reach 90% full scale
- Ambient humidity : up to 95% relative humidity
- Operating Temperature : Ambient to 40°C (instrument is temperature compensated so that a 20°C change in temperature corresponds to a change in reading of ± 2% full scale at maximum sensitivity.

3.2 Power Requirements and Operating Times

- Continuous use on battery : approximately 10 hours
- Continuous use with HNu recorder reduces instrument battery operating time to approximately 5 hours
- Recharge time : less than 14 hours; a 3 hours charge will charge up to 90% full charge
- Recharge Current : maximum 0.4 amps at 15 VDC

TABLE 1 LAMP SOURCE IONIZATION POTENTIALS FOR ORGANIC AND INORGANIC AIRBORNE COMPOUNDS

9.5 eV Lamp Source

Acids (organic)
Alcohols
Amines
Aniline
Aromatics
Benzene
Borontribromide
Chlorinated aromatics
Dimethyldisulfide
Dimethylsulfide
Ketones
Phenol
Pyridine
Styrene
Toluene

10.2 eV Lamp Source

Acetaldehyde
Acetic acid
Acetone
Acids (organic)
Acrolein (acelyates)
Alcohols
Aldehydes
Aliphatics
Alkyl halides
Allyl alcohol
Amides
Amines
Ammonia
Aniline
Aromatics
Arsine
Asphalt emissions
Benzene
Bromine
Butane
Boron tribromide
Carbon disulfide
Chlorinated aromatics
Chlorinated hydrocarbons
Chloropenes
Cyclohexanane
Dibromochloropropene
Dichloropropylene
Dimethyl disulfide
Dimethyl formal denyde
Dimethyl sulfide
Epichlorhydrin
Esters
Ethanol
Ethyl methacrylate
Ethylene
Ethylene dibromide
Ethylene imine
Ethylene oxide
Furan
Heterocyclics
Hexane
Hexamethyl phosphoric triamide
Hydrazine
Hydrogen sulfide
Hydrogen selenide

TABLE 1 (CONTINUED)

10.2 eV Lamp Source (Cont'd.)	
Iodine vapor	Phosphine
Isopropanol	Phosphorus trichloride
Ketones	Picolines
Lutidines	Pinene
Methyl bromide	Propylene
Methyl isocyanate	Pyridine
Methyl mercaptan	Pyrole
Methyl methacrylate	Styrene
Mineral spirits	Tetrahydrofuran
Naptha	Tetraethyl lead
Nitrates	Thionyl chloride
Nitrites	Toluene
Nitro alkanes	Vinyl acetate
Nitro benzene	Vinyl bromide
N-Octane	Vinyl chloride
Olefins	Vinylidine chloride
Phenol	
Phostoxin	

11.7 Lamp Source	
Acetic anhydride	Formic acid
Acetylene	Methanol
Acrylonitrile	Methylene chloride
Alcohols	Nitrates
Aldehydes	Nitrites
Alphatics	Nitro alkanes
Alkyl halides	Phostoxin
Butane	Propane
Carbon tetrachloride	Serafume
Chloroform	
Ethane	
Ethylene dichloride	
Formaldehyde	

TABLE 1 RELATIVE SENSITIVITIES FOR VARIOUS GASES
(10.2 eV Lamp)

Species	Photoionization Sensitivity*
p-xylene	11.4
m-xylene	11.2
benzene	10.0 (reference standard)
toluene	10.0
diethyl sulfide	10.0
diethyl amine	9.9
styrene	9.7
trichloroethylene	8.9
carbon disulfide	7.1
isobutylene	7.0
acetone	6.3
tetrahydrofuran	6.0
methyl ethyl ketone	5.7
methyl isobutyl ketone	5.7
cyclohexanone	5.1
naptha (85% aromatics)	5.0
vinyl chloride	5.0
methyl isocyanate	4.5
iodine	4.5
methyl mercaptan	4.3
dimethyl sulfide	4.3
allyl alcohol	4.2
propylene	4.0
mineral spirits	4.0
2,3-dichloropropene	4.0
cyclohexene	3.4
crotonaldehyde	3.1
acrolein	3.1
pyridine	3.0
hydrogen sulfide	2.8
ethylene dibromide	2.7
n-octane	2.5
acetaldehyde oxime	2.3
hexane	2.2
phosphine	2.0
heptane	1.7
allyl chloride (3-chloropropene)	1.5
ethylene	1.0
ethylene oxide	1.0
acetic anhydride	1.0
a-pinene	0.7
dibromochloropropane	0.7
epichlorohydrin	0.7
nitric oxide	0.6

TABLE 2 RELATIVE SENSITIVITIES FOR VARIOUS GASES (10.2 eV Lamp) (Continued)

Species	Photoionization Sensitivity*
b-pinene	0.5
citral	0.5
ammonia	0.3
acetic acid	0.1
nitrogen dioxide	0.02
methane	0.0
acetylene	0.0

*Expressed in ppm (v/v).

II. OPERATIONAL PROCEDURE

1.0 Instrument Check-Out

1.1 Remove instrument box cover by pulling up on fasteners.

1.2 On the instrument panel, there will be a label containing information on light source, calibration date, calibration gas, and span setting.

1.2.1 If the instrument has not been calibrated in the last 14 days or since its last field use, it should be recalibrated. Check the instrument log, which should be maintained with the instrument, for the instrument status and its calibration history. For general use, the instrument should be calibrated to isobutylene at a span setting of 9.8.

1.2.2 Check the label for light source and refer to Table 1 for ionization potentials of various compounds. If the compound you wish to detect is not listed for the light sources provided with instrument, then the light source will have to be changed. Use the probe with the proper light source for the compounds to be detected.

1.2.3 Once it has been determined that the instrument has the correct lamp, the instrument may need to be recalibrated for the specific compound of interest. Use Procedure under 2.1.3 of this Section to calibrate the instrument.

1.2.4 Check the battery supply by connecting the probe to the instrument box, and turning the function switch to the battery check position (Figure 1). (Note: The battery check indicator will not function unless the probe is attached.) The meter needle should deflect to the far right or above the green zone. If the needle is below or just within the green zone or the red LED indicator is on, the battery should be recharged. Follow the procedure described in Section III (Maintenance and Trouble shooting) to recharge the battery.

1.2.5 Repack the instrument for shipment to the field.

2.0 Field Operation

2.1 Calibration

2.1.1 Equipment and Materials

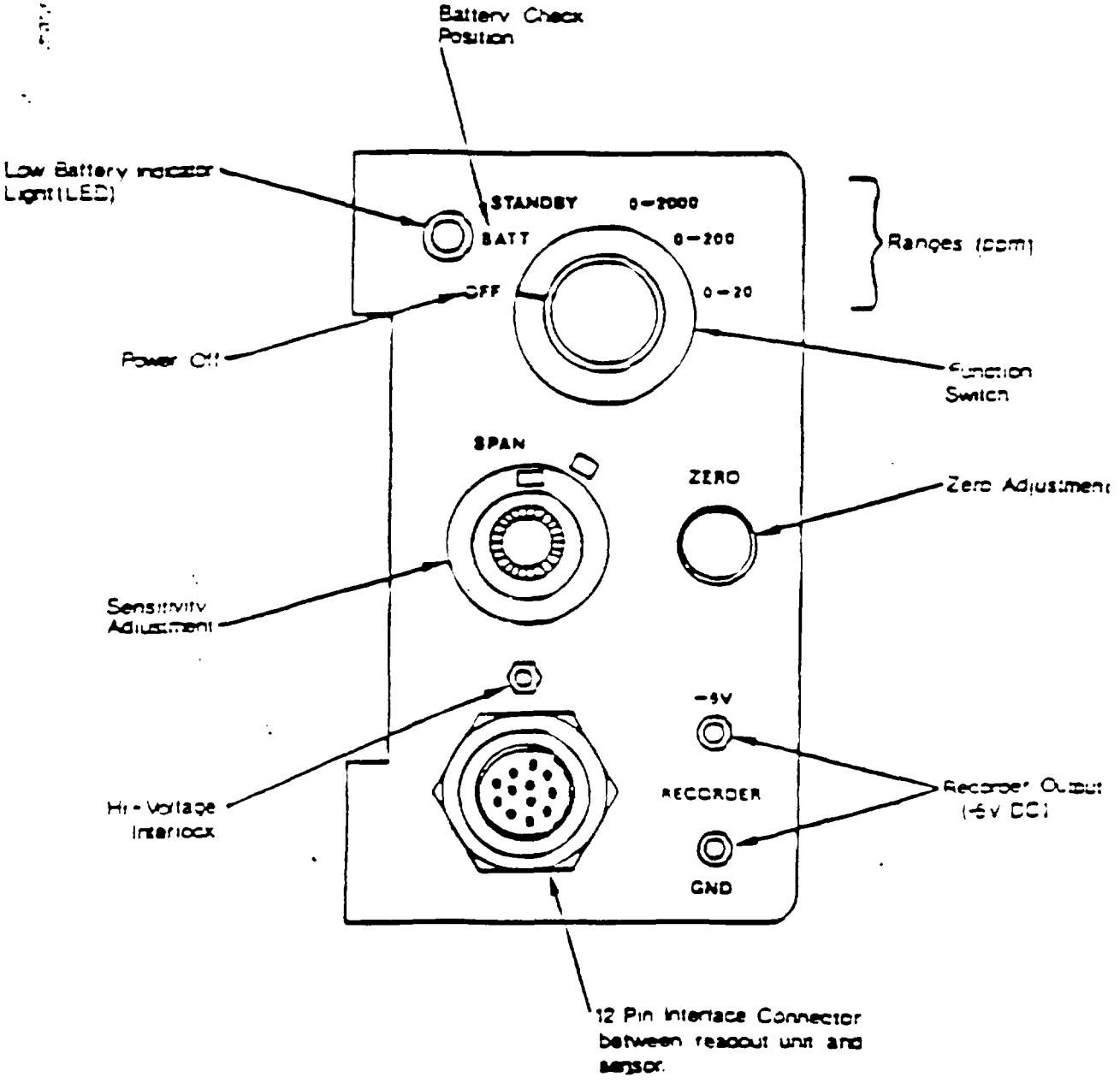


FIGURE 1 INSTRUMENT CONTROL PANEL FEATURES

- Calibration Gas (2 ranges)

  Low range 0-20 ppm and mid-range 20-200 ppm of isobutylene gas are used for standard field operation when contaminants are unknown or a mixture of gases is present. The isobutylene gas is used for general calibration because of the instrument's relatively high sensitivity to it and the non-toxic nature of the gas.
  Note: A specialty gas may be required if a single atmospheric contaminant is present and the contaminant has a sensitivity different from that of the calibration gas (isobutylene).

- Tubing and fittings (see Figure 2).

- Rotometer or bubble flow meter.

- Field Log, calibration form, and data reporting form.

- Table 1 for ionization potentials for compounds of interest.

2.1.2 Calibration Frequency

This instrument should be calibrated after each field use and prior to each field use. Continuous calibration check should be performed frequently during field operation (for example, check the instrument zero and calibration after every 10 measurements) and document the results properly. Caution: Do Not Change the Settings.

2.1.3 Calibration Procedure

2.1.3.1 Use a three-points procedure to facilitate the proper instrument calibration over appropriate operating ranges. Distinct mixtures of calibration gas with known concentration for selective operating range should be used for calibration. Each mixture should give a 3/4 scale deflection in its respective operating range.

2.1.3.2 Instrument Setup.

Step 1: Remove Instrument cover by pulling up on the side straps.

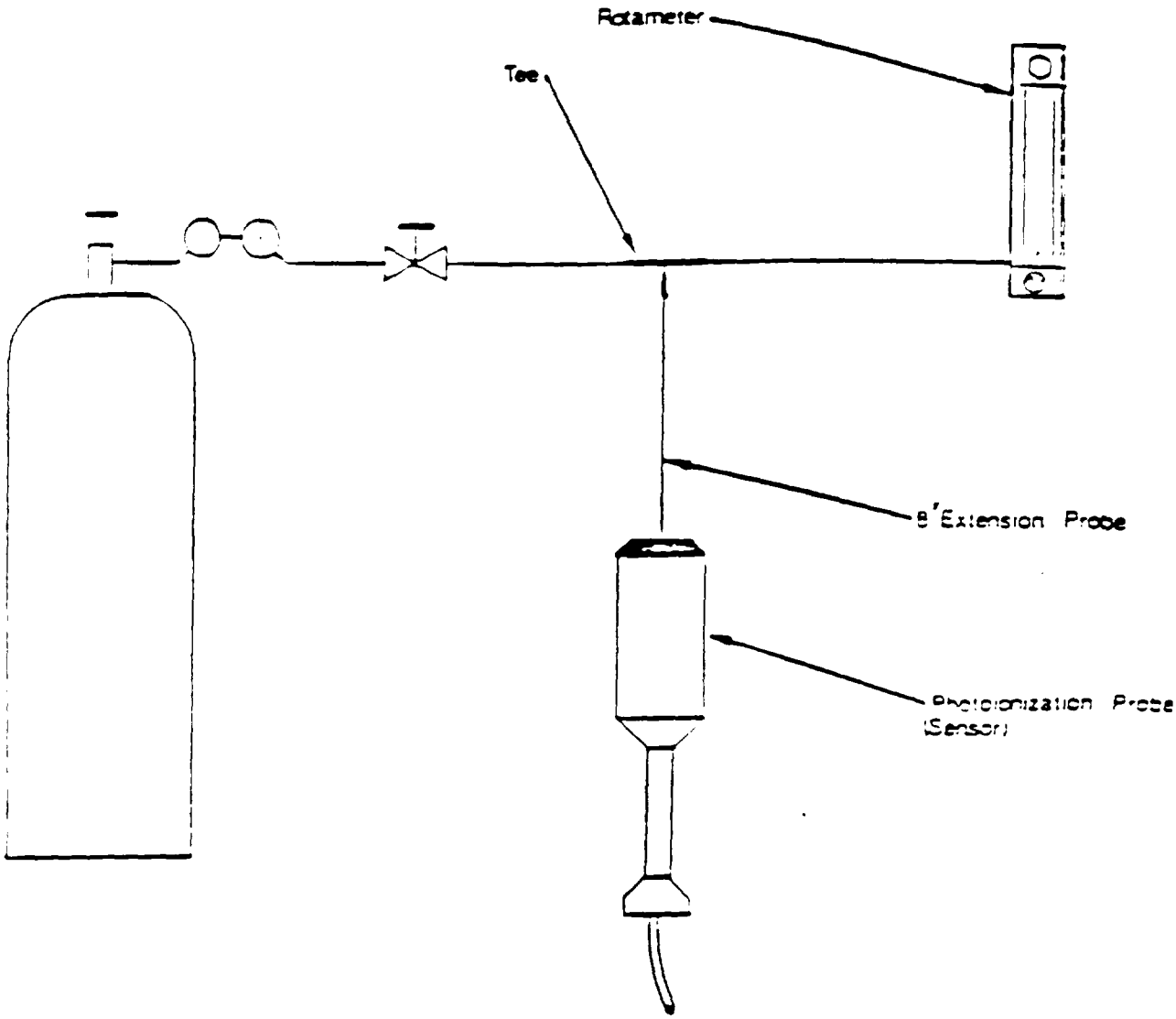


FIGURE 2 RECOMMENDED CALIBRATION PROCEDURE FOR PHOTOIONIZATION ANALYZER

Step 2: Prior to calibration, check the function switch (Figure 1) on the control panel to make sure it is in the OFF position. The probe nozzle is stored inside the instrument cover. Remove cover plate by pulling up on the pins that fasten the cover plate.

Step 3: Remove the nozzle from the cover. Assemble probe by screwing nozzle into casing.

Step 4: Attach probe cable to instrument box inserting 12 pin interface connector of the probe cable into the connector on the instrument panel. Match the alignment keys and insert connector. Turn connector in clockwise direction until a distinct snap and lock is felt.

Step 5: Turn the function switch to the Battery Check position. When the battery is charged, the needle should read within or above the green battery arc on the scale plate. If the needle is below the green arc or the red LED light comes on, the instrument should be recharged prior to making any measurements. Implement steps in Section III to recharge battery.

Step 6: Turn the function switch to the ON position. In this position, the UV light source should be on. To verify, gaze at the end of the probe for a purple glow. Do Not Look Directly at the Lamp Itself. If the lamp does not come on refer to Maintenance Step in 2.2 (Section III).

Step 7: To zero the instrument, turn the function switch to the standby position and rotate the zero potentiometer until the meter reads zero. Clockwise rotation of the zero potentiometer produces an upscale deflection while counter clockwise rotation yields a downscale deflection. (Note: No zero gas is needed since this is an electronic zero adjustment.) If the span adjustment is changed during instrument calibration, the zero should be rechecked and adjusted. If necessary, wait 15 to 20 seconds to ensure that the zero reading is stable. Readjust as necessary.

2.1.3.3 Calibration Steps

Step 1: Insert one end of T tube (Figure 2) into probe. Insert second end of probe into calibration gas in the 20-200 ppm range. The third end of probe should have the rotometer (bubble meter) attached.

Step 2: Set the function switch in the 0-200 ppm range. Crack the valve on the pressured calibration gas container until a slight flow is indicated on the rotometer. The instrument will draw in the volume required for detection with the rotometer indicating excess flow.

Step 3: Adjust the span potentiometer so that the instrument is reading the exact value of the calibration gas. (Calibration gas value is labeled on the cylinder).

Step 4: Turn instrument switch to the standby position and check the electronic zero. Reset zero potentiometer as necessary following step 7 of 2.1.3.2.

Step 5: Record on form and field log all original and readjusted settings as specified in the form.

Step 6: Next, set the function switch to the 0-20 ppm. Remove the mid-range (20-200 ppm) calibration gas cylinder and attach the low range (0-20 ppm) calibration gas cylinder as described above.

Step 7: Do not adjust the span potentiometer. The observed reading should be ±3 ppm of the concentration specified for the low range calibration gas. If this is not the case, recalibrate the mid range scale repeating Step 1 thru 6 above. If the low range reading consistently falls outside the recommended tolerance range, the probe light source window likely needs cleaning. Clean window following Step 2 under 2.3 (Section III). When the observed reading is within the required tolerances, the instrument is fully calibrated.

2.2 Sample Measurement

Step 1: Place function switch in 0-20 ppm range for field monitoring. This will allow for the most sensitive, quick response in detecting airborne contaminants.

Step 2: Before entering a contaminanted area, determine background concentration. This concentration should be used as a reference to readings made in the contaminated area. Under no circumstance should one attempt to adjust the zero or span adjustments while the instrument is being operated in the field.

Step 3: Take measurements in contaminated area, recording readings and locations. Should readings exceed the 0-20 scale, switch the function switch to the 0-200 or 0-2,000 range as appropriate to receive a direct reading. Return the instrument switch to the 0-20 range when readings are reduced to that level. Record measuremeasurements in notebook or on an appropriate form.

Step 4: Keep in mind health and safety action guidelines for the level of protection you are wearing. Sustained readings above a certain level may force you to vacate an area or upgrade your level of protection.

Note: The instrument will not function properly in high humidity or when the window to the light housing is dirty. If the instrument response is erratic or lower than expected.

Step 5: When finisned, use the reverse Steps 1 thru 5 of Section 2.1.3.2 (Instrument Setup) to shut down the instrument.

III. MAINTENANCE AND TROUBLE-SHOOTING

1.0 Battery Recharging

1.1 The instrument should be recharged 1 hour for each hour of use or overnight for a full day's use. (The battery will last 10 hours on a full charge.)

1.2 To recharge the battery (or instrument):

1.2.1 Turn the function switch to the off position.

1.2.2 Remove the charger from the instrument top compartment.

1.2.3 Place the charger plug into the jack on the left side of the instrument box.

1.2.4 Connect the charger unit to a 120 V AC supply.

1.2.5 Check charger function by turning the instrument switch to the battery check position. The meter should go upscale if the charger is working and is correctly inserted into the jack.

1.2.6 Place instrument in instrument mode and charge for the appropriate time period.

1.2.7 Turn the instrument off following the recharge cycle. When disconnecting charger, remove from 120 V AC supply before removing the mini phone plug.

2.0 General Fault Determination and Correction

2.1 Battery level is low. Recharge if necessary implementing steps described under 1.0 (Section III). If the battery will not recharge, it will have to be replaced.

2.2 UV Lamp function - Gaze at sample inlet when mode switch is on an instrument function position and observe for purple glow of lamp. If the lamp does not glow in any of the three instrument function positions, it may be burned out and will have to be replaced. To replace the lamp:

1. Turn the function switch to the off position and disconnect the probe connector from the readout unit.

2. Remove the exhaust screw found near the base of the probe (Figure 3).

3. Grasp the end cap in one hand and the probe shell in the other and gently pull to separate the end cap and lamp housing from the shell.

4. Loosen the screws on the top of the end cap and separate the end cap and ion chamber from the lamp and lamp housing. Care must be taken so that the ion chamber does not fall out of the end cap and the lamp does not slide out of the lamp housing.

5. Turn the end cap over in your hand and tap on the top of it; the ion chamber should fall out of it.

6. Place one hand over the top of the lamp housing and tilt slightly. The light source will slide out of the housing.

7. Replace lamp with one of same energy source as the one removed by sliding it into the housing. Note: The amplifier board and instrument circuitry are calibrated for one light energy

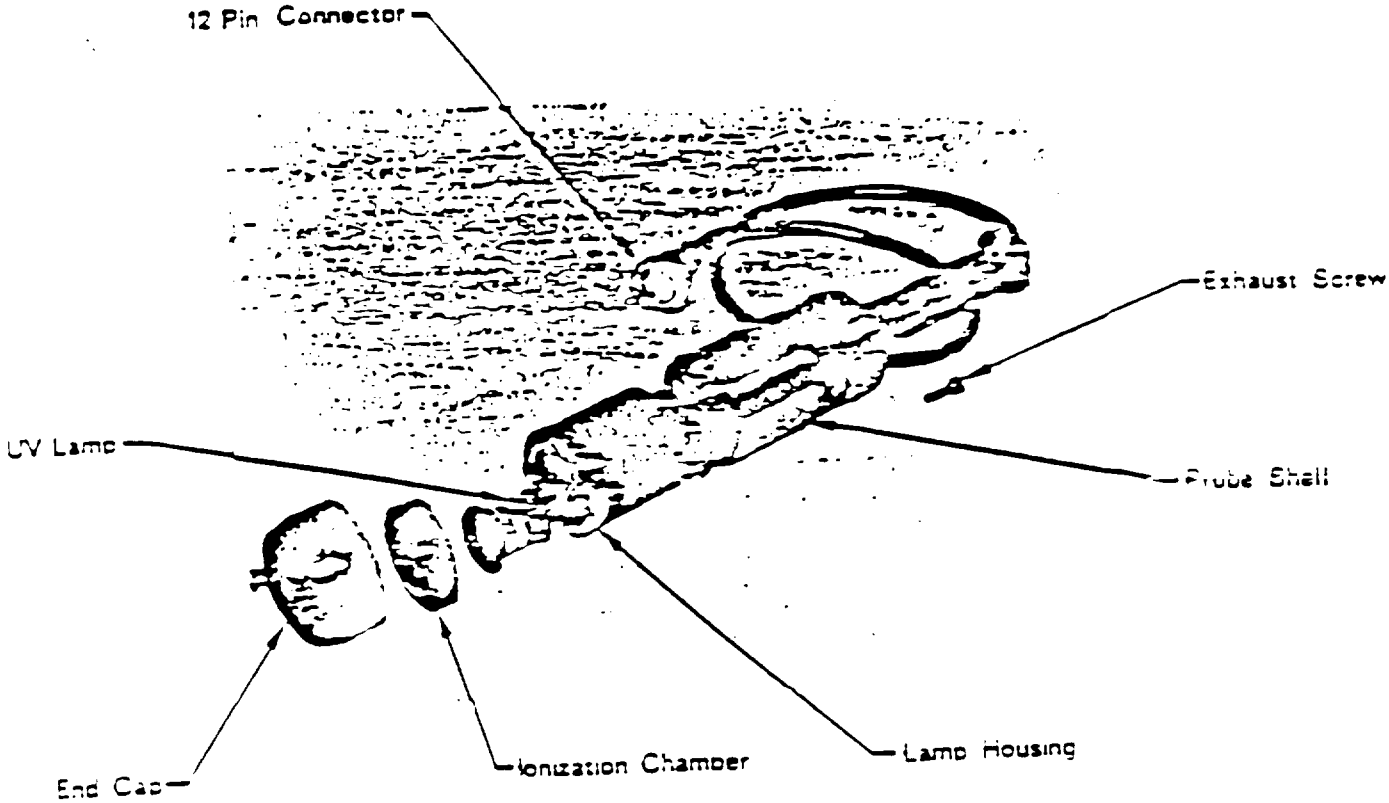


FIGURE 3 COMPONENT PARTS OF PROBE

8. Place the ion chamber on top of the lamp housing, checking to ensure that the contacts are aligned.

9. Place the end cap on top of the ion chamber and replace the two screws. The screws should be tightened only enough to seal the "O" ring. Do not overtighten.

10. Line up the pins on the base of the lamp housing with the pins inside the probe shell. Gently slide the housing assembly into the probe shell. Do not force the assembly as it only fits one way.

11. Replace and tighten the exhaust screw.

12. Reconnect the 12 pin connector and turn instrument mode switch to a function position. Check for glow of lamp. If lamp still does not function, the instrument has an electrical short or other problem that will have to be corrected at the factory.

2.3 Instrument appears to be functional, but responses are lower than expected or erratic. The window of the light source may be dirty and need to be cleaned. To clean the light source window:

1. Disassemble the probe assembly by repeating Steps 1 thru 6 under 2.2 above.

2. Clean the window of the light source using compound provided with instrument and soft clean cloth. Important: Use cleaning compound on the window of the 10.2 eV lamp only. The cleaning compound may damage the windows of the 9.5 and 11.7 eV lamps.

3. Reassemble the probe assembly repeating Step 7 through 12 above.

3.0 Specific Faults

3.1 No meter response in any switch position (including BATT CHK)

1. Broken meter movement: Tip instrument rapidly from side to side. Meter needle should move freely, and return to zero.

2. Electrical connection to meter is broken: Check all wires leading to meter and clean the contacts of quick-disconnects.

3. Battery is completely dead: Disconnect battery and check voltage with a volt-ohm meter.

4. Check 2 amp fuse.

5. If none of the above solves the problem, consult the factory.

3.2 Meter responds in BATT CHK position, but reads zero or near zero for all others.

1. Power supply defective: Check power supply voltages per Figure 4. If any voltage is out of specification, consult the factory.

2. Input transistor or amplifier has failed: Rotate zero control; meter should deflect up/down as control is turned. Open probe; both transistors should be fully seated in sockets.

3. Input signal connection broken in probe or readout: Check input connector on printed circuit board. Should be firmly pressed down. Check components on back side of printed circuit board. All connections should be solid, and no wires should touch any other object. Check all wires in readout for solid connections.

3.3 Instrument responds correctly in BATT CHK, and STBY, but not in measuring mode.

1. Check to see the light source is on (See Section 2.2).

2. Check high voltage power supply (See Figure 4).

3. Open end of probe, remove lamp and check high voltage on lamp contact ring.

4. If high voltage is present at all above points, light source has most likely failed. Consult the factory.

3.4 Instrument responds correctly in all positions, but signal is lower than expected.

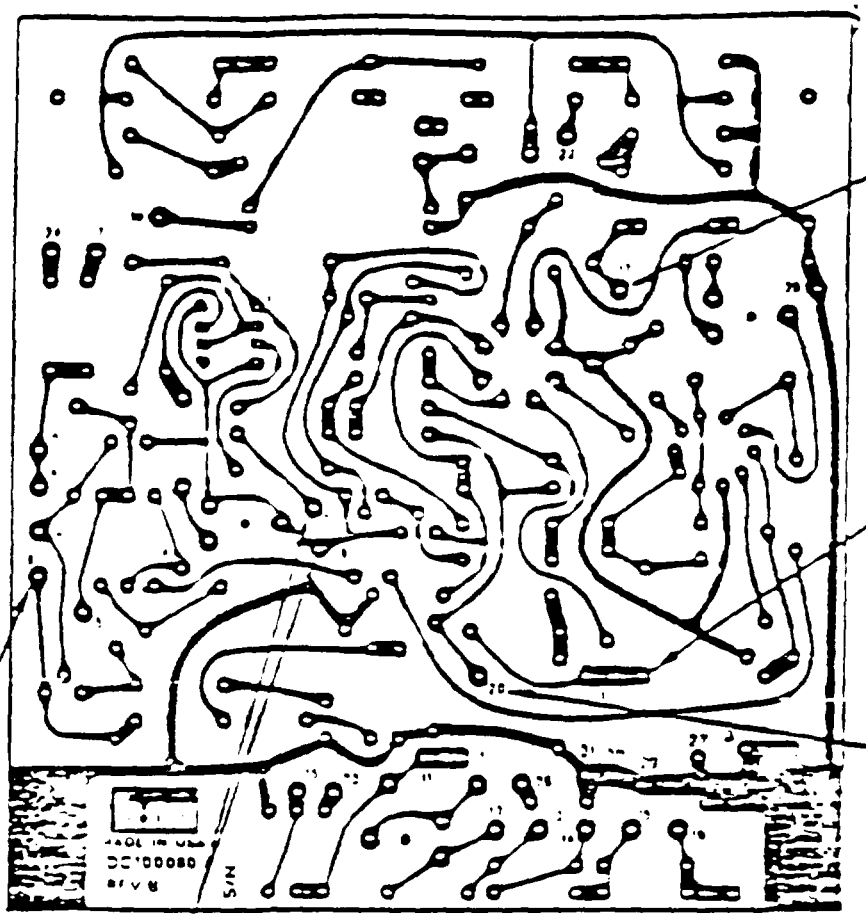
1. Check span setting for correct value.

2. Clean window of light source (See 2.3).

3. Double check preparation of standards.

4. Check power supply 180 V output. See Figure 4.

5. Check for proper fan operation. Check fan voltage. See Figure 4.



All Voltages Respect to Ground							
pads	voltage	pads	voltage	pads	voltage	pads	voltage
1	− 5.7V	9	− 12.2V	17	180V	25	0
2	GRD	10	− 12.1V	18	+ 19.4V	26	0
3	GRD	11	0	19	− 10.6V	27	GRD
4	−10 7V	12	0	20	− 9.7V	28	0
5	− 11.3V	13	0	21	−14 5V	29	GRD
6	− 12.1V	14	0	22	−400V	30	GRD
7	0	15	0	23	0	31	GRD
8	− 12.2V	16	0	24	0		

Figure 4 Power Supply PC Board

6. Rotate span setting. Response should change if span pot is working properly.

3.5 Instrument responds in all switch positions, but is noisy (erratic meter movement).

1. Open circuit in feedback circuit. Consult the factory.

2. Open circuit in cable shield or probe shield. Consult the factory.

3.6 Instrument response is slow and/or irreproducible.

1. Fan operating improperly. Check fan voltage. See Figure 4.

2. Check calibration and operation.

3.7 Low battery indicator.

1. Indicator comes on if battery charge is low.

2. Indicator also comes on if ionization voltage is too high.

APPENDIX C

CERTIFICATION OF COMPLETION
INITIAL, SITE-SPECIFIC HEALTH AND SAFETY TRAINING

ERM-NORTH CENTRAL, INC.

CERTIFICATE of COMPLETION

Initial Site - Specific Training Program

SIGNATURE	DATE
Onsite Project Safety Officer	DATE

APPENDIX D

PROTECTIVE EQUIPMENT/DECONTAMINATION PROCEDURES

APPENDIX D

PROTECTIVE EQUIPMENT/DECONTAMINATION PROCEDURES

1.0 INTRODUCTION

Personal protective equipment must be worn during field work activities when: (1) atmospheric contamination is known or suspected to exist, (2) there is a potential for the generation of vapors or gases, or (3) direct contact with toxic substances may occur.

The On-Site PSO will determine the level or combination of personal protective equipment that affords the appropriate level of protection and ensure that safe work practices are followed. The requirements specified for Levels A, B, C, and D protection are outlined in the section that follows.

2.0 LEVELS OF PROTECTION

2.1 Level D

2.1.1 Personal Protective Equipment

- Work uniform
- Coveralls - cotton or chemical resistant
- Gloves (outer) - safety or chemical resistant
- Boots/shoes (inner) - chemical resistant, steel toe and shank
- Boots (outer) - chemical resistant, disposable
- Hard hat with face shield or goggles
- Escape mask (optional)

2.1.2 Criteria for Selection

Level D protection should be used when:

- No contaminants are present; and
- Work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with any chemicals.

Level D protection is primarily a work uniform. It can be worn only in areas where there is no possibility of contact with contamination.

2.2 Level C

2.2.1 Personal Protective Equipment

- Full-face, air-purifying respirator-canister or cartridge (OSHA/NIOSH approved)
- Chemical-resistant clothing - disposable hooded, one- or two-piece chemical splash suit
- Gloves (outer) - chemical resistant
- Gloves (inner) - chemical resistant (optional)
- Boots (inner) - chemical resistant, steel toe and shank
- Disposable boot covers (outer) - if leather work boots are worn, then outer chemical-resistant boots are necessary
- Hard hat
- Escape mask (optional)
- Two-way radio - intrinsically safe (optional)

2.2.2 Criteria for Selection

Meeting all of the following criteria permits the use of Level C protection:

- Oxygen concentrations are not less than 19.5 percent by volume.

- The types of air contaminants have been identified, concentrations have been measured, and an air-purifying respirator is available that can remove the contaminants.

- Measured air concentrations of identified substances will be reduced by the respirator below the substance's threshold limit value (TLV), and the concentration is within the service limit of the canister.

- Atmospheric contaminant concentrations do not exceed Immediately Dangerous to Life and Health (IDLH) levels.

- Atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin.

- Job functions do not require self-contained breathing apparatus.

- Direct readings are a few ppms above background on instruments such as the FID or PID.

- All criteria for the use of air-purifying respirators are met.

2.2.3 Decontamination Procedures

See Figure 1.

2.3 Level B

2.3.1 Personal Protective Equipment

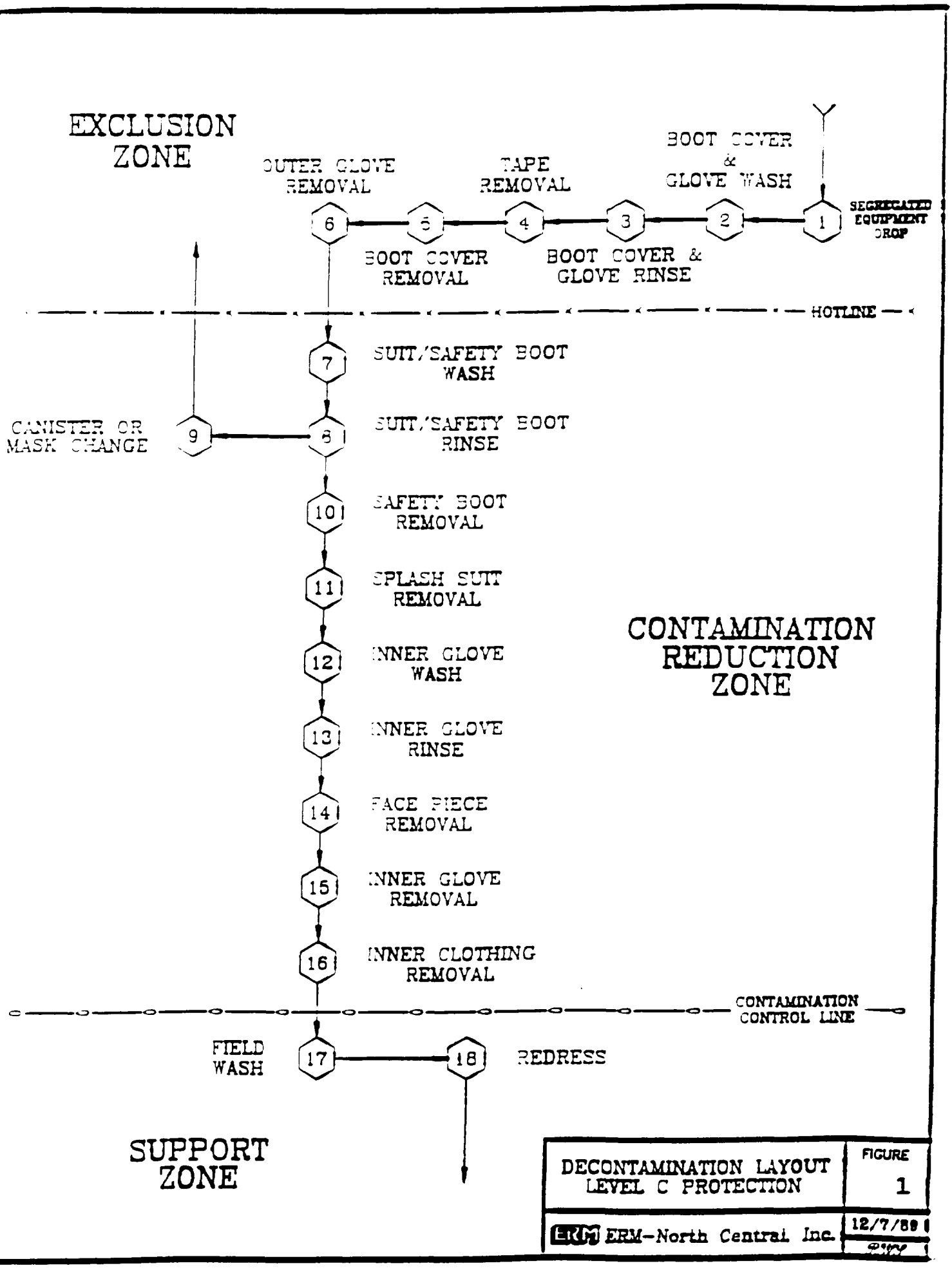
- Self-contained breathing apparatus (SCBA)-pressure-demand regulator (OSHA/NIOSH approved)

- All items from Level C protection

2.3.2 Criteria for Selection

Meeting any one of the following criteria warrants use of Level B protection:

- The type and atmospheric concentration of substances have been identified and require a high level of respiratory protection, but less skin protection than Level A. These would be:


EXCLUSION ZONE
OUTER GLOVE REMOVAL
TAPE REMOVAL
BOOT COVER & GLOVE WASH
SEGREGATED EQUIPMENT DROP
6
5
4
3
2
1
BOOT COVER REMOVAL
BOOT COVER & GLOVE RINSE
HOTLINE
7
SUIT/SAFETY BOOT WASH
CANISTER OR MASK CHANGE
9
8
SUIT/SAFETY BOOT RINSE
10
SAFETY BOOT REMOVAL
11
SPLASH SUIT REMOVAL
12
INNER GLOVE WASH
13
INNER GLOVE RINSE
14
FACE PIECE REMOVAL
15
INNER GLOVE REMOVAL
16
INNER CLOTHING REMOVAL
CONTAMINATION REDUCTION ZONE
CONTAMINATION CONTROL LINE
FIELD WASH
17
18
REDRESS
SUPPORT ZONE
DECONTAMINATION LAYOUT LEVEL C PROTECTION
FIGURE 1
ERM ERM-North Central Inc.
12/7/88

- Atmospheres with Immediately Dangerous to Life and Health (IDLH) concentrations, but the substance or its concentration in air does not represent a severe skin hazard, or

- Chemicals or concentrations involved do not meet the selection criteria permitting the use of air-purifying respirators.

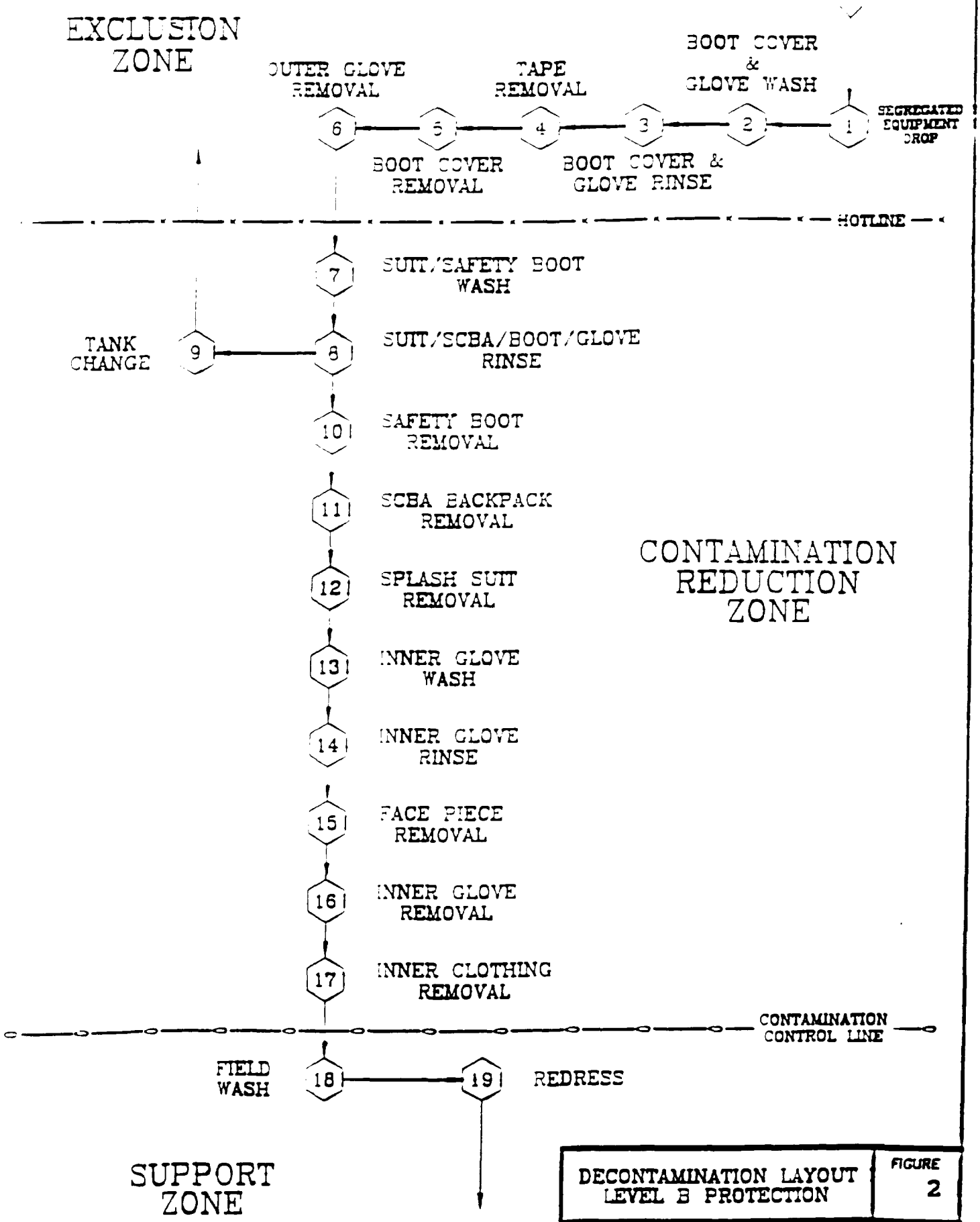
- o The atmosphere contains less than 19.5 percent oxygen.

- o It is highly unlikely that the work being done will generate high concentrations of vapors, gases or particulates, or splashes of material that will affect the skin.

- o Atmospheric concentrations of unidentified vapors or gases are indicated by direct readings on instruments such as the FID or PID or similar instruments, but vapors and gases are not suspected of containing concentrations of skin toxicants.

2.3.3 Decontamination Procedures

See Figure 2.



DECONTAMINATION LAYOUT LEVEL B PROTECTION	FIGURE 2
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2.4 Level A

2.4.1 Personal Protective Equipment

- Fully encapsulating chemical-resistant suit
- Disposable protective suit, gloves, and boots (depending on suit construction) - worn over totally encapsulating suit (optional)
- All items from Level B protection

2.4.2 Criteria for Selection

Meeting any of the following criteria warrants use of Level A protection:

- The chemical substance has been identified and requires the highest level of protection for skin, eyes, and the respiratory system based on either the measured (or potential for) high concentrations of atmospheric vapors, gases, or particulates.
- The site operations and work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to the skin or are capable of being absorbed by the skin.

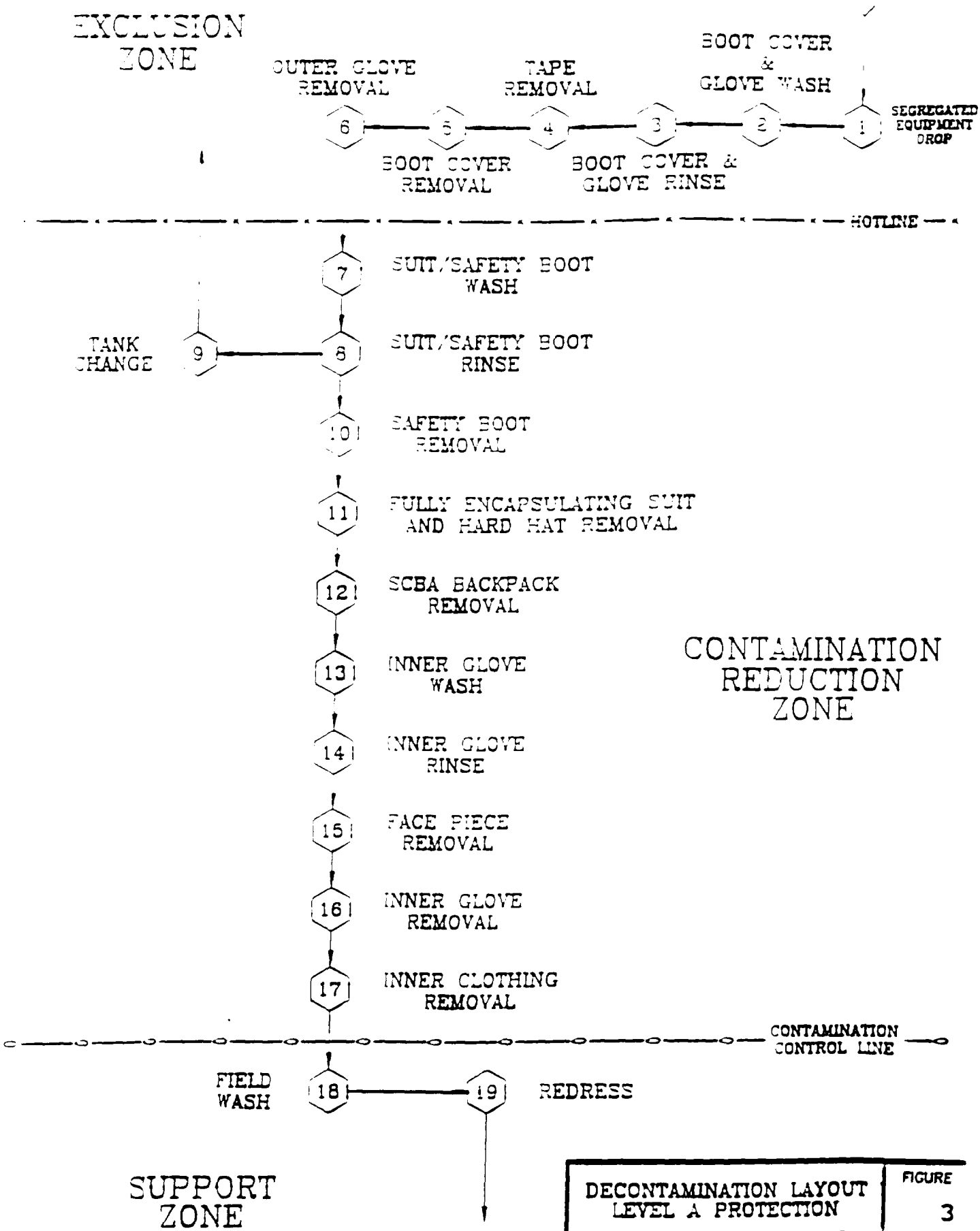
- Substances with a high degree of hazard to the skin are known or suspected to be present, and skin contact is possible. Skin contact includes: splash, immersion, or contamination from atmospheric vapors, gases, or particulates.

- Operations are being conducted in confined, poorly ventilated areas, and the absence of conditions requiring Level A have not yet been determined.

- Direct readings on field FID or PID and similar instruments indicate high levels of unidentified vapors and gases in the air.

2.4.3 Decontamination Procedures

See Figure 3.



DECONTAMINATION LAYOUT
LEVEL A PROTECTION

FIGURE 3

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